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A STUDY OF THE EFFECTS OF ENVIRONMENTAL AND
ABLATOR PERFORMANCE UNCERTAINTIES ON HEAT
SHIELDING REQUIREMENTS FOR HYPERBOLIC ENTRY
VEHICLES
VOLUME II - SUMMARY OF CALCULATIONS

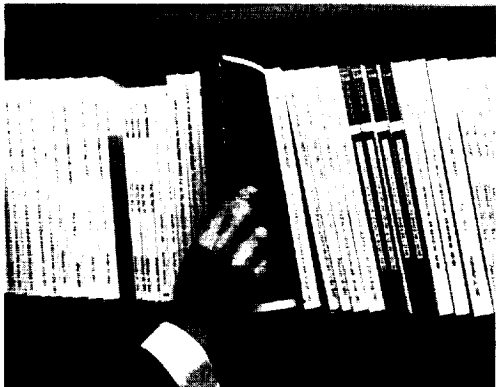
L. F. Hearne, et al

Lockheed Missiles & Space Company
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1. The subject reports prepared under Contract NAS 2-4219 have been reviewed at Ames and are recommended for release in STAR as follows:

- a. CR 73223 "Radiation Transport for Blunt-Body Flows Including the Effects of Lines and Ablation Layer" Volume III by Jin H. Chin
- b. CR 73224 "A Study of the Effects of Environmental and Ablator Performance Uncertainties on Heat Shielding Requirements for Hyperbolic Entry Vehicles" Volume I, Final Report by L.F. Hearne, W.D. Coleman, J.M. Lefferdo, L.W. Gallegher and J. H. Chin.
- c. CR 73225 "A Study of the Effects of Environmental and Ablator Performance Uncertainties on Heat Shielding Requirements for Hyperbolic Entry Vehicles" Volume 2, Summary of Calculations by L.F. Hearne, W.D. Coleman, J. M. Lefferdo, L. W. Gallegher and J. H. Chin.

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Enclosure: 1 cy ea subject report (less graphs on CR 73225)
1 reproducible cy ea subject report

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A STUDY OF THE EFFECTS OF ENVIRONMENTAL
AND ABLATOR PERFORMANCE UNCERTAINTIES
ON HEAT SHIELDING REQUIREMENTS FOR
HYPERBOLIC ENTRY VEHICLES

VOLUME II - SUMMARY OF CALCULATIONS

Prepared By

By L. F. Hearne, W. D. Coleman, J. M. Lefferdo,
L. W. Gallagher and J. H. Chin

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FOREWARD

This report, termed the Summary of Calculations, is one of a series of three reports which describe work performed for the National Aeronautics and Space Administration, Ames Research Center, under Contract No. NAS 2-4¹219. The complete set of reports issued in this study are:

- Volume I - Final Report
- Volume II - Summary of Calculations
- Volume III - Radiation Transport Analyses

N. S. Vojvodich served as the study technical monitor.

CONTENTS

This report is the second of three volumes which contain a description of the work performed in this study. It consists of output from an automatic plotting sub-routine attached to the ablator material response prediction code, TRANSIENT.

For each condition for which results are presented, a set of four graphs are shown which consists of:

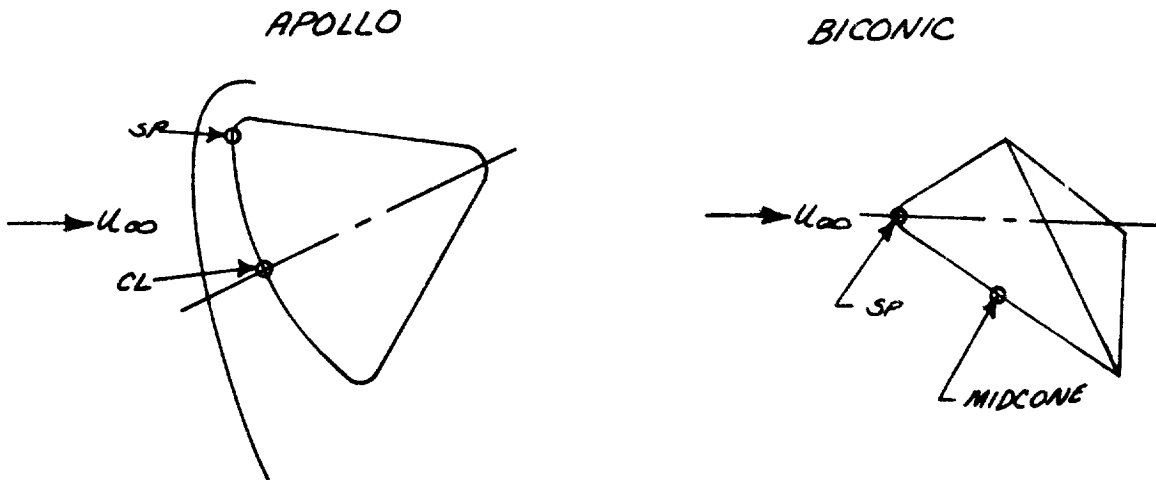
- . Radiative and convective (with and without blowing) heating rate histories
- . Surface temperature histories
- . Material degradation histories consisting of surface recession and char layer thickness
- . Energy accommodation histories

The various quantities are plotted for the nylon-phenolic heat shielding material as a function of flight time from 400,000 feet altitude. Of the first three graphs, some are shown for the complete heating period, the conclusion of which may be arbitrarily defined as the time when material degradation ceases. Because of computer storage limitations, however, which allowed only a set number of points to be stored for plotting, some of the curves do not extend completely to the end of the heating period, although they nearly do. The energy accommodation graph covers only the first half of the heating period, which allows a clarification of the various accommodation levels during the maximum heating pulse, the period of primary interest.

Data for two locations on each vehicle are presented. The conditions for which data are shown include approximately one-half of those cases examined for the Biconic and nearly all cases examined for the Apollo. The various vehicle locations, trajectory conditions, and parameters investigated are indexed on the following pages.

GUIDE TO INDEX

1. Figure Number - The figure number prefix, A or B, refers to the Apollo or Biconic vehicle, respectively.
2. Vehicle Location - Graphs are presented for two locations on each vehicle, the flight stagnation point (SP), and a location which typifies the material response and environment which exists over the majority of the respective forebodies. For the Apollo, this location is the forebody geometric centerline (CL), and for the Biconic it is a point mid-way aft on the cone ($S/R_n = 8.6$ where S/R_n is wetted length ratioed to the vehicle nose radius).



3. Parameter Investigated - Uncertainties investigated include:
 - a) Limited mass transpiration effectiveness - the blowing to nonblowing heat transfer coefficient ratio may not decrease below a value of 0.3.
 - b) Increased surface emissivity - the emissivity is increased to 0.9 from its baseline value of 0.6.
 - c) Frozen pyrolysis gases - pyrolysis gas enthalpies are based upon a gas whose species concentrations are frozen at their decomposition levels.
 - d) Radiation - the upper estimate is obtained by approximately doubling baseline absorption coefficients; the lower estimate is obtained by approximately halving absorption coefficients

and also accounting for ablation layer absorption.

- e) Decreased sublimation temperature - the sublimation temperature is reduced approximately 600°F by accounting for pyrolysis gas-char chemical reactions in the ablation model.
- f) Boundary layer transition - all turbulent heating is investigated for both vehicles; for the Biconic, the effects of various wetted length transition Reynolds numbers (Re_{sc}) are examined.

INDEX

Figure Number	Entry Velocity (ft/sec x10 ⁻³)	Corridor Position	Vehicle Location	Parameter Investigated
A1	45	Undershoot	SP	Baseline
A2	"	"	"	Limited mass transpiration effectiveness
A3	"	"	"	Increased surface emissivity
A4	"	"	"	Frozen pyrolysis gases
A5	"	"	"	Lower estimate of radiation
A6	"	"	"	Coupled effects - upper estimate of radiation plus frozen pyrolysis gases
A7	45	Undershoot	CL	Baseline
A8	"	"	"	Limited mass transpiration effectiveness
A9	"	"	"	Increased surface emissivity
A10	"	"	"	All turbulent heating
A11	"	"	"	Frozen pyrolysis gases
A12	"	"	"	Lower estimate of radiation
A13	"	"	"	Coupled effects - upper estimate of radiation plus frozen pyrolysis gases
A14	50	Undershoot	SP	Baseline
A15	"	"	"	Limited mass transpiration effectiveness
A16	"	"	"	Increased surface emissivity
A17	"	"	"	Frozen pyrolysis gases
A18	"	"	"	Lower estimate of radiation
A19	"	"	"	Coupled effects - upper estimate of radiation plus frozen pyrolysis gases
A20	50	Undershoot	CL	Baseline
A21	"	"	"	Limited mass transpiration effectiveness
A22	"	"	"	Increased surface emissivity
A23	"	"	"	All turbulent heating
A24	"	"	"	Frozen pyrolysis gases
A25	"	"	"	Lower estimate of radiation
A26	"	"	"	Coupled effects - upper estimate of radiation plus frozen pyrolysis gases
A27	57	Undershoot	SP	Baseline
A28	"	"	"	Limited mass transpiration effectiveness
A29	"	"	"	Increased surface emissivity

Figure Number	Entry Velocity (ft/sec $\times 10^{-3}$)	Corridor Position	Vehicle Location	Parameter Investigated
A30	57	Undershoot	SP	Frozen pyrolysis gases
A31	"	"	"	Lower estimate of radiation
A32	"	"	"	Coupled effects - upper estimate of radiation plus frozen pyrolysis gases
A33	57	Undershoot	CL	Baseline
A34	"	"	"	Limited mass transpiration effectiveness
A35	"	"	"	Increased surface emissivity
A36	"	"	"	All turbulent heating
A37	"	"	"	Frozen pyrolysis gases
A38	"	"	"	Lower estimate of radiation
A39	"	"	"	Coupled effects - upper estimate of radiation plus frozen pyrolysis gases
A40	50	Intermediate	SP	Baseline
A41	"	"	"	Lower estimate of radiation
A42	"	"	"	Upper estimate of radiation
A43	50	Intermediate	CL	Baseline
A44	"	"	"	Lower estimate of radiation
A45	"	"	"	Upper estimate of radiation
A46	45	Overshoot	SP	Baseline
A47	"	"	"	Limited mass transpiration effectiveness
A48	"	"	"	Increased surface emissivity
A49	"	"	"	Frozen pyrolysis gases
A50	"	"	"	Lower estimate of radiation
A51	"	"	"	Coupled effects - upper estimate of radiation plus frozen pyrolysis gases
A52	45	Overshoot	CL	Baseline
A53	"	"	"	Limited mass transpiration effectiveness
A54	"	"	"	Increased surface emissivity
A55	"	"	"	All turbulent heating
A56	"	"	"	Frozen pyrolysis gases
A57	"	"	"	Lower estimate of radiation
A58	"	"	"	Coupled effects - upper estimate of radiation plus frozen pyrolysis gases
A59	50	Overshoot	SP	Baseline
A60	"	"	"	Limited mass transpiration effectiveness

Figure Number	Entry Velocity (ft/sec $\times 10^{-3}$)	Corridor Position	Vehicle Location	Parameter Investigated
A61	50	Overshoot	SP	Increased surface emissivity
A62	"	"	"	Frozen pyrolysis gases
A63	"	"	"	Decreased sublimation temperature
A64	"	"	"	Radiation-Increased absorption coefficients, with ablation layer absorption
A65	"	"	"	Radiation-Nominal absorption coefficients, with ablation layer absorption
A66	"	"	"	Radiation-Decreased absorption coefficients, no ablation layer absorption
A67	"	"	"	Lower estimate of radiation
A68	"	"	"	Coupled effects - upper estimate of radiation plus frozen pyrolysis gases
A69	50	Overshoot	CL	Baseline
A70	"	"	"	Limited mass transpiration effectiveness
A71	"	"	"	Increased surface emissivity
A72	"	"	"	All turbulent heating
A73	"	"	"	Frozen pyrolysis gases
A74	"	"	"	Decreased sublimation temperature
A75	"	"	"	Radiation-Increased absorption coefficients, with ablation layer absorption
A76	"	"	"	Radiation-Nominal absorption coefficients, with ablation layer absorption
A77	"	"	"	Radiation-Decreased absorption coefficients, no ablation layer absorption
A78	"	"	"	Lower estimate of radiation
A79	"	"	"	Coupled effects-upper estimate of radiation, frozen pyrolysis gases, and all turbulent heating
A80	"	"	"	Coupled effects - upper estimate of radiation plus frozen pyrolysis gases
A81	57	Overshoot	SP	Baseline
A82	"	"	"	Limited mass transpiration effectiveness
A83	"	"	"	Increased surface emissivity
A84	"	"	"	Frozen pyrolysis gases
A85	"	"	"	Lower estimate of radiation
A86	"	"	"	Coupled effects - upper estimate of radiation plus frozen pyrolysis gases
A87	57	Overshoot	CL	Baseline
A88	"	"	"	Limited mass transpiration effectiveness

Figure Number	Entry Velocity (ft/sec $\times 10^{-3}$)	Corridor Position	Vehicle Location	Parameter Investigated
A89	57	Overshoot	CL	Increased surface emissivity
A90	"	"	"	All turbulent heating
A91	"	"	"	Frozen pyrolysis gases
A92	"	"	"	Lower estimate of radiation
A93	"	"	"	Coupled effects - upper estimate of radiation plus frozen pyrolysis gases

Figures A94 through A105 pertain to the decreased weight vehicle (ballistic coefficient = 78 lb/ft²)

A94	50	Undershoot	SP	Baseline
A95	"	"	"	Frozen pyrolysis gases
A96	"	"	"	Lower estimate of radiation
A97	50	Undershoot	CL	Baseline
A98	"	"	"	Frozen pyrolysis gases
A99	"	"	"	Lower estimate of radiation
A100	50	Overshoot	SP	Baseline
A101	"	"	"	Frozen pyrolysis gases
A102	"	"	"	Lower estimate of radiation
A103	50	Overshoot	CL	Baseline
A104	"	"	"	Frozen pyrolysis gases
A105	"	"	"	Lower estimate of radiation

Figures A106 through A117 pertain to the increased volume vehicle (ballistic coefficient = 86 lb/ft²)

A106	50	Undershoot	SP	Baseline
A107	"	"	"	Frozen pyrolysis gases
A108	"	"	"	Lower estimate of radiation
A109	50	Undershoot	CL	Baseline
A110	"	"	"	Frozen pyrolysis gases
A111	"	"	"	Lower estimate of radiation
A112	50	Overshoot	SP	Baseline
A113	"	"	"	Frozen pyrolysis gases
A114	"	"	"	Lower estimate of radiation
A115	50	Overshoot	CL	Baseline
A116	"	"	"	Frozen pyrolysis gases
A117	"	"	"	Lower estimate of radiation

Figure Number	Entry Velocity (ft/sec x10 ⁻³)	Corridor Position	Vehicle Location	Parameter Investigated
B1	45	Undershoot	SP	Baseline
B2	"	"	"	Limited mass transpiration effectiveness
B3	"	"	"	Increased surface emissivity
B4	"	"	"	Frozen pyrolysis gases
B5	45	Undershoot	Mid-Cone	Baseline
B6	"	"	"	All turbulent heating
B7	"	"	"	Limited mass transpiration effectiveness
B8	"	"	"	Increased surface emissivity
B9	"	"	"	Frozen pyrolysis gases
B10	"	"	"	Coupled effects - frozen pyrolysis gases and transition ($Re_{s_c} = 10^5$)
B11	50	Undershoot	SP	Baseline
B12	"	"	"	Limited mass transpiration effectiveness
B13	"	"	"	Increased surface emissivity
B14	"	"	"	Frozen pyrolysis gases
B15	50	Undershoot	Mid-Cone	Baseline
B16	"	"	"	All turbulent heating
B17	"	"	"	Transition - $Re_{s_c} = 5 \times 10^5$
B18	"	"	"	Transition - $Re_{s_c} = 10^5$
B19	"	"	"	Limited mass transpiration effectiveness
B20	"	"	"	Increased surface emissivity
B21	"	"	"	Frozen pyrolysis gas
B22	"	"	"	Coupled effects - frozen pyrolysis gases and transition ($Re_{s_c} = 10^5$)
B23	57	Undershoot	SP	Baseline
B24	"	"	"	Limited mass transpiration effectiveness
B25	"	"	"	Increased surface emissivity
B26	"	"	"	Frozen pyrolysis gases
B27	57	Undershoot	Mid-Cone	Baseline
B28	"	"	"	All turbulent heating
B29	"	"	"	Limited mass transpiration effectiveness
B30	"	"	"	Increased surface emissivity
B31	"	"	"	Frozen pyrolysis gases
B32	"	"	"	Coupled effects - frozen pyrolysis gases and transition ($Re_{s_c} = 10^5$)

Figure Number	Entry Velocity (ft/sec x 10 ⁻³)	Corridor Position	Vehicle Location	Parameter Investigated
B33	45	Overshoot	SP	Baseline
B34	"	"	"	Limited mass transpiration effectiveness
B35	"	"	"	Increased surface emissivity
B36	"	"	"	Frozen pyrolysis gases
B37	45	Overshoot	Mid-Cone	Baseline
B38	"	"	"	All turbulent heating
B39	"	"	"	Limited mass transpiration effectiveness
B40	"	"	"	Increased surface emissivity
B41	"	"	"	Frozen pyrolysis gases
B42	"	"	"	Coupled effects - frozen pyrolysis gases and transition ($Re_{Sc} = 10^5$)
B43	50	Overshoot	SP	Baseline
B44	"	"	"	Limited mass transpiration effectiveness
B45	"	"	"	Increased surface emissivity
B46	"	"	"	Frozen pyrolysis gases
B47	50	Overshoot	Mid-Cone	Baseline
B48	"	"	"	All turbulent heating
B49	"	"	"	Transition - $Re_{Sc} = 5 \times 10^5$
B50	"	"	"	Transition - $Re_{Sc} = 10^5$
B51	"	"	"	Limited mass transpiration effectiveness
B52	"	"	"	Increased surface emissivity
B53	"	"	"	Frozen pyrolysis gases
B54	"	"	"	Coupled effects - frozen pyrolysis gases and transition ($Re_{Sc} = 10^5$)
B55	57	Overshoot	SP	Baseline
B56	"	"	"	Limited mass transpiration effectiveness
B57	"	"	"	Increased surface emissivity
B58	"	"	"	Frozen pyrolysis gases
B59	57	Overshoot	Mid-Cone	Baseline
B60	"	"	"	All turbulent heating
B61	"	"	"	Limited mass transpiration effectiveness
B62	"	"	"	Increased surface emissivity
B63	"	"	"	Frozen pyrolysis gases
B64	"	"	"	Coupled effects - frozen pyrolysis gases and transition ($Re_{Sc} = 10^5$)



FIGURE A1

HEATING RATE HISTORY

APOLLO 48K LB

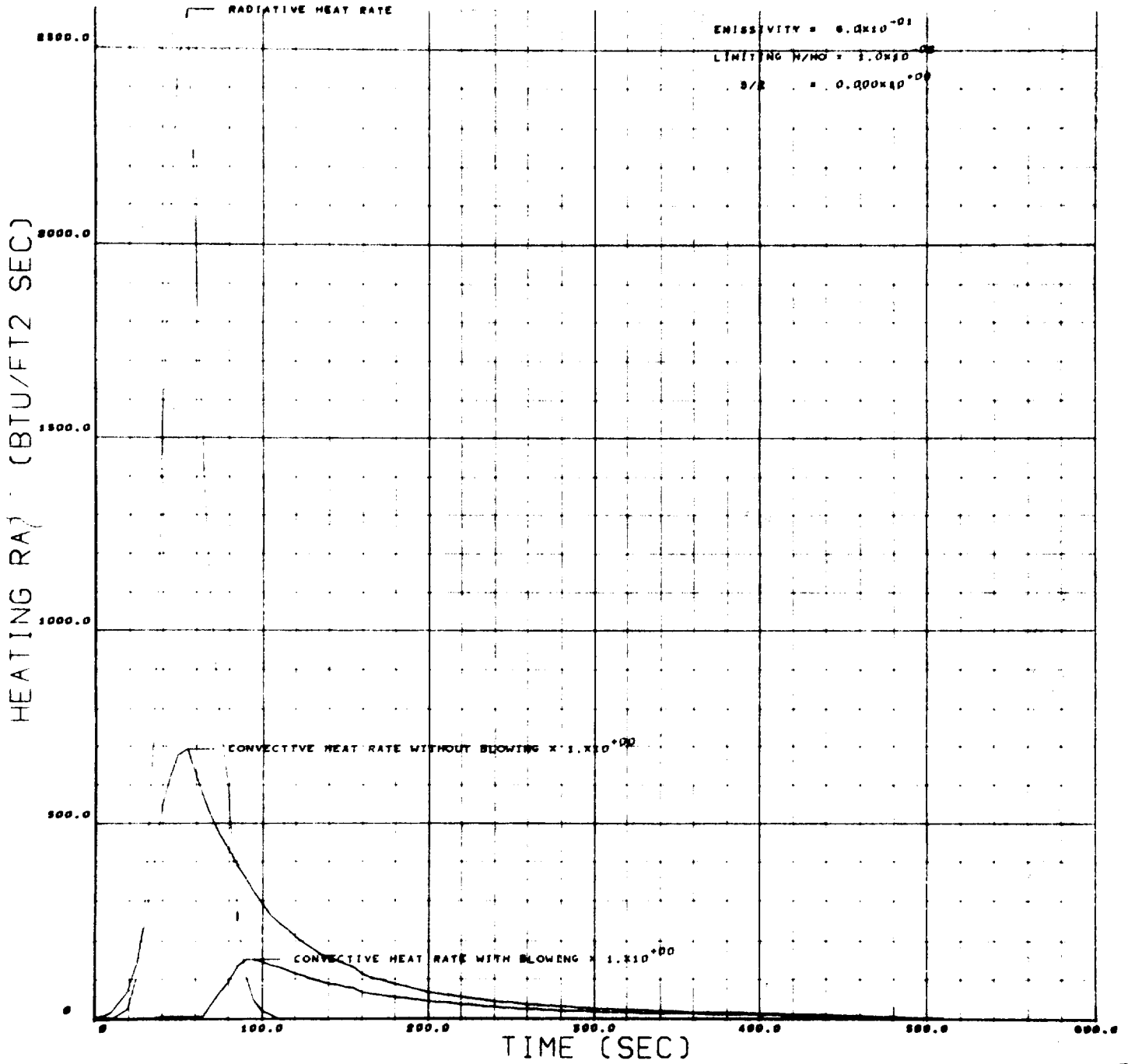


FIGURE A1

MATERIAL RESPONSE DATA

APOLLO 45K LB

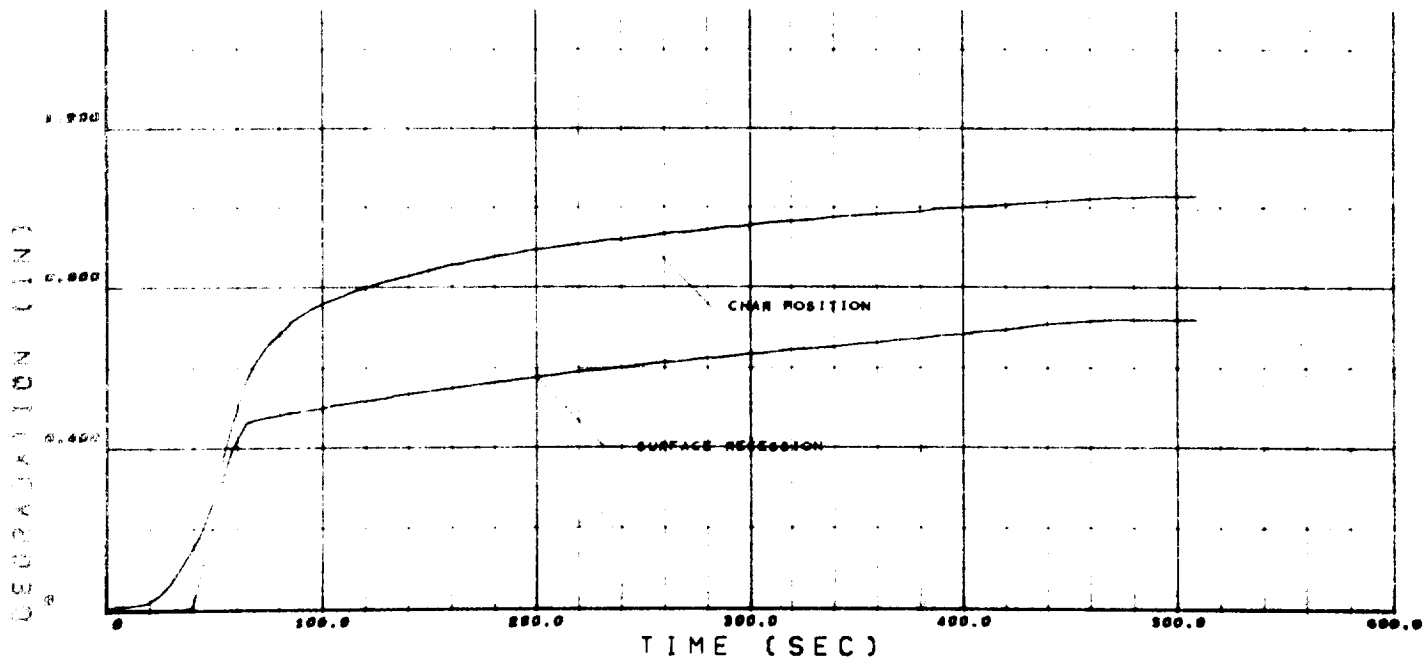
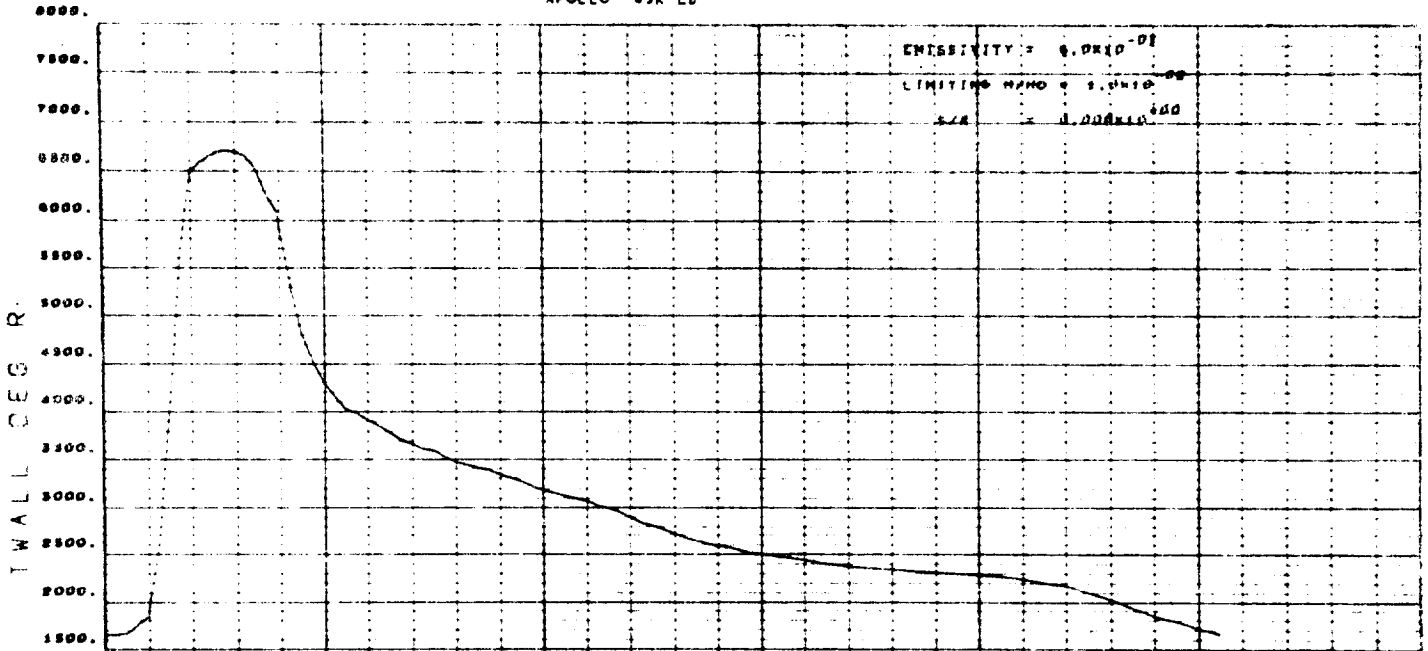


FIGURE A1 ENERGY ACCOMMODATION MECHANISMS

APOLLO 45K LB

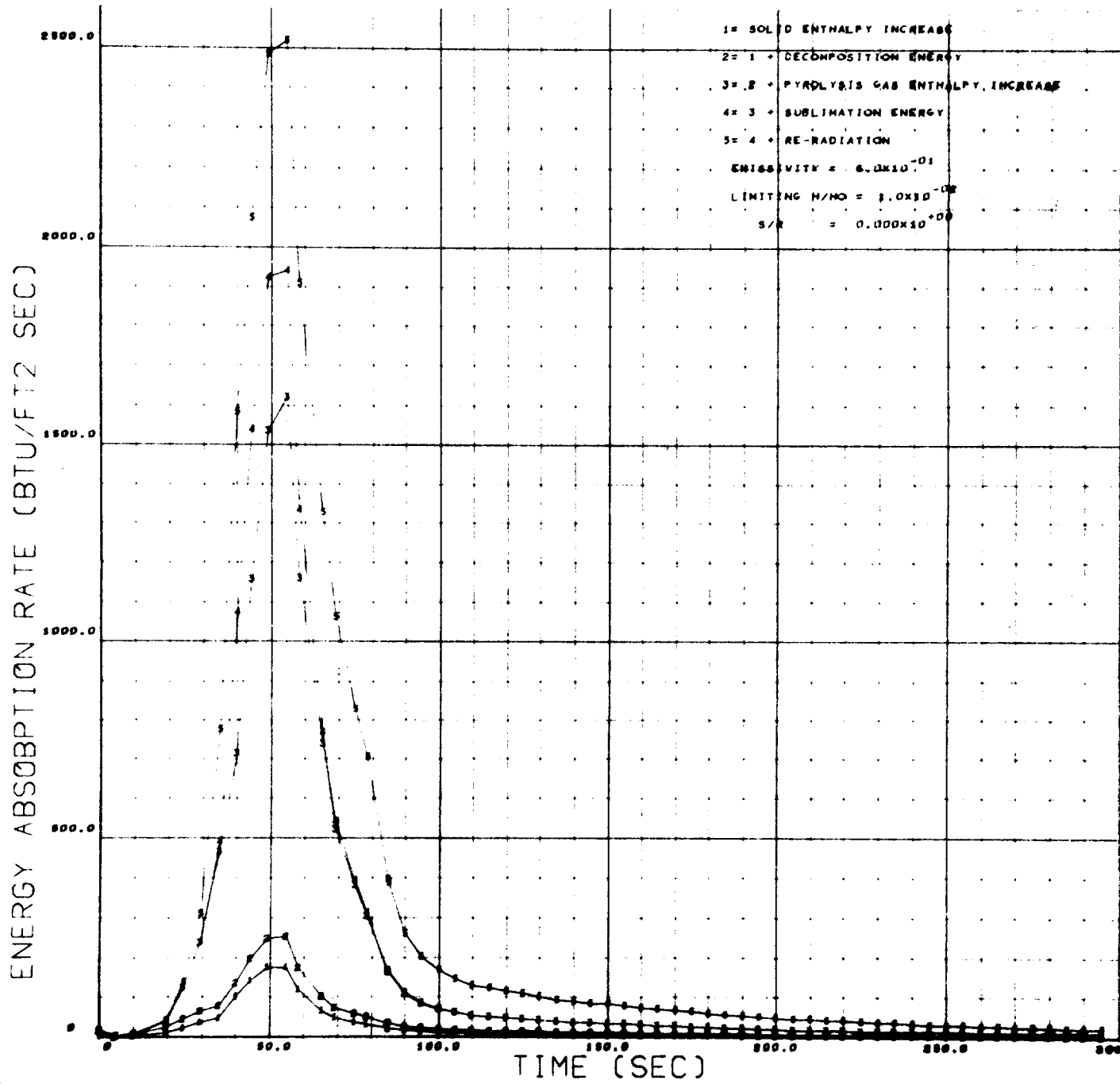


FIGURE A2 HEATING RATE HISTORY

APOLLO 45K LB

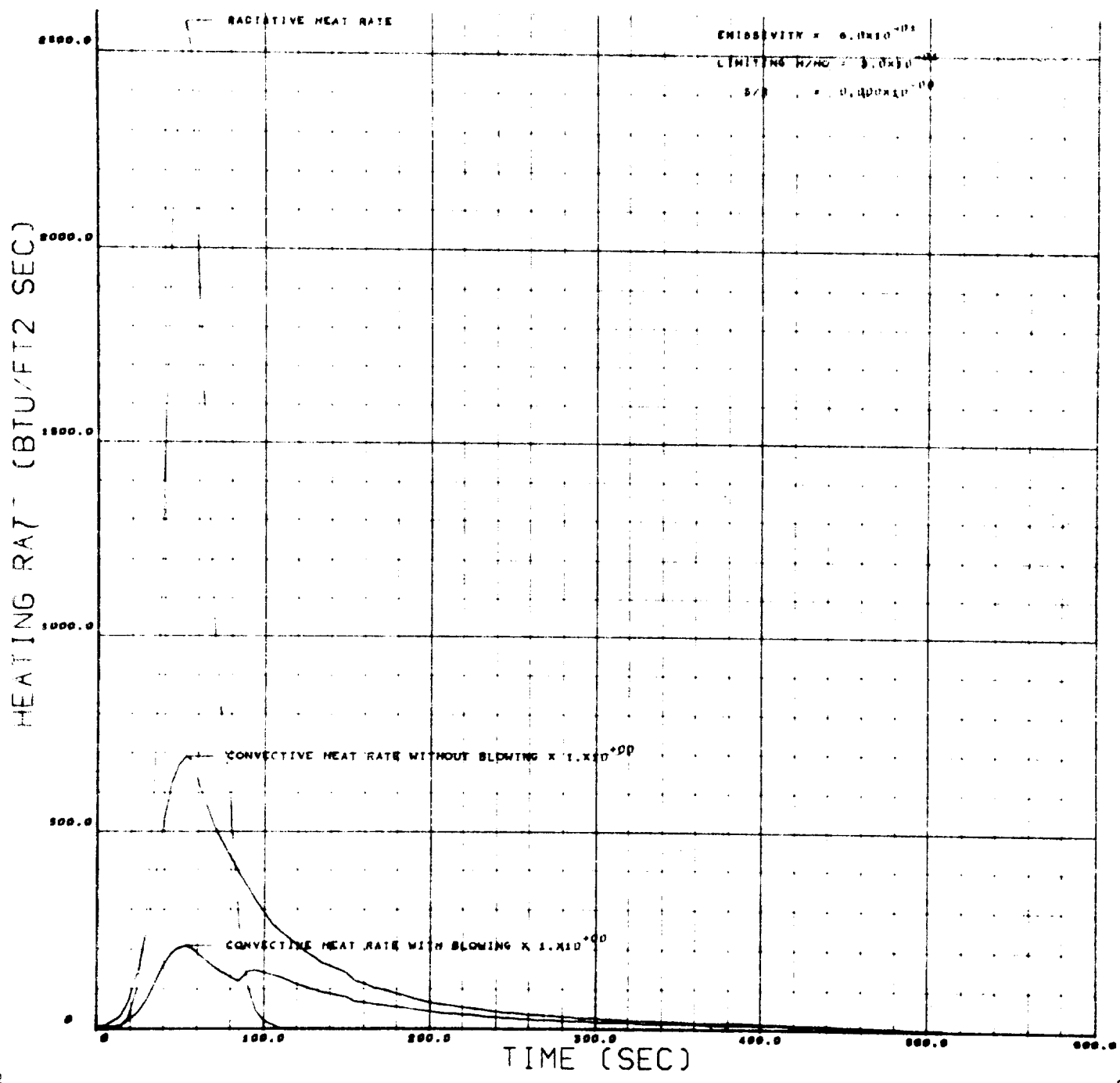


FIGURE A2

MATERIAL RESPONSE DATA

APOLLO 43K LB

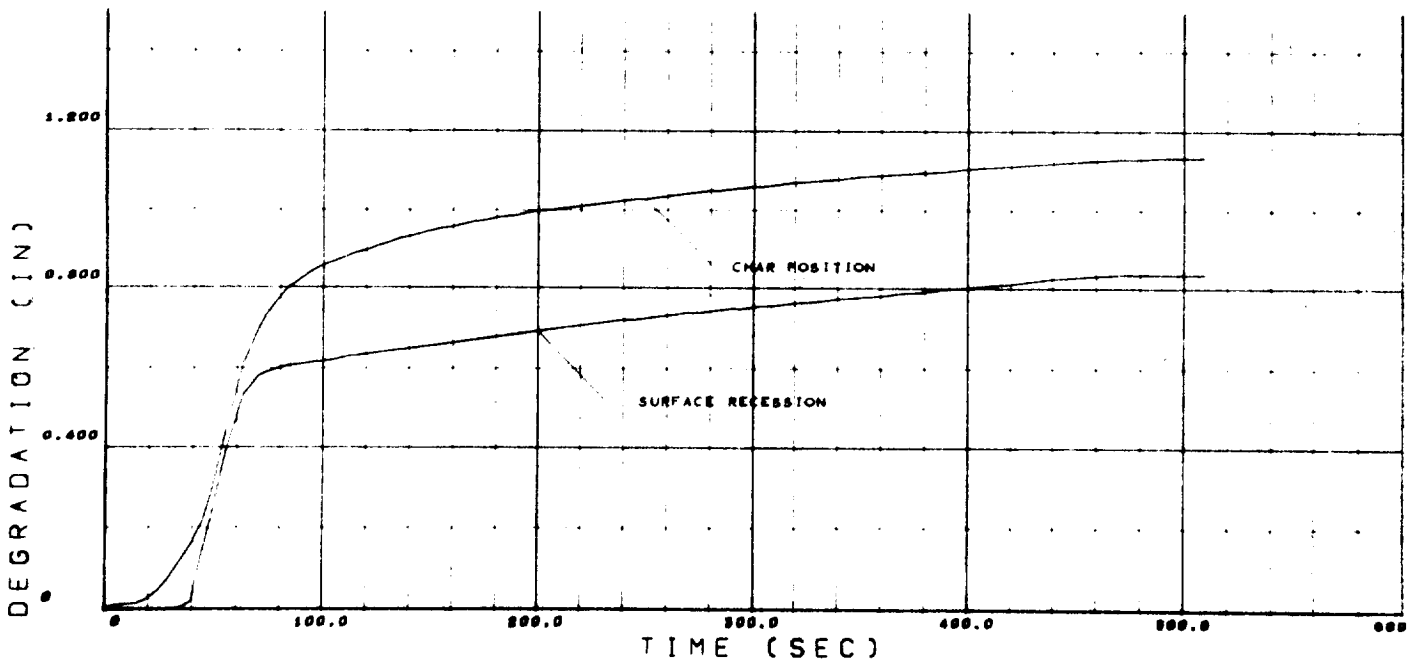
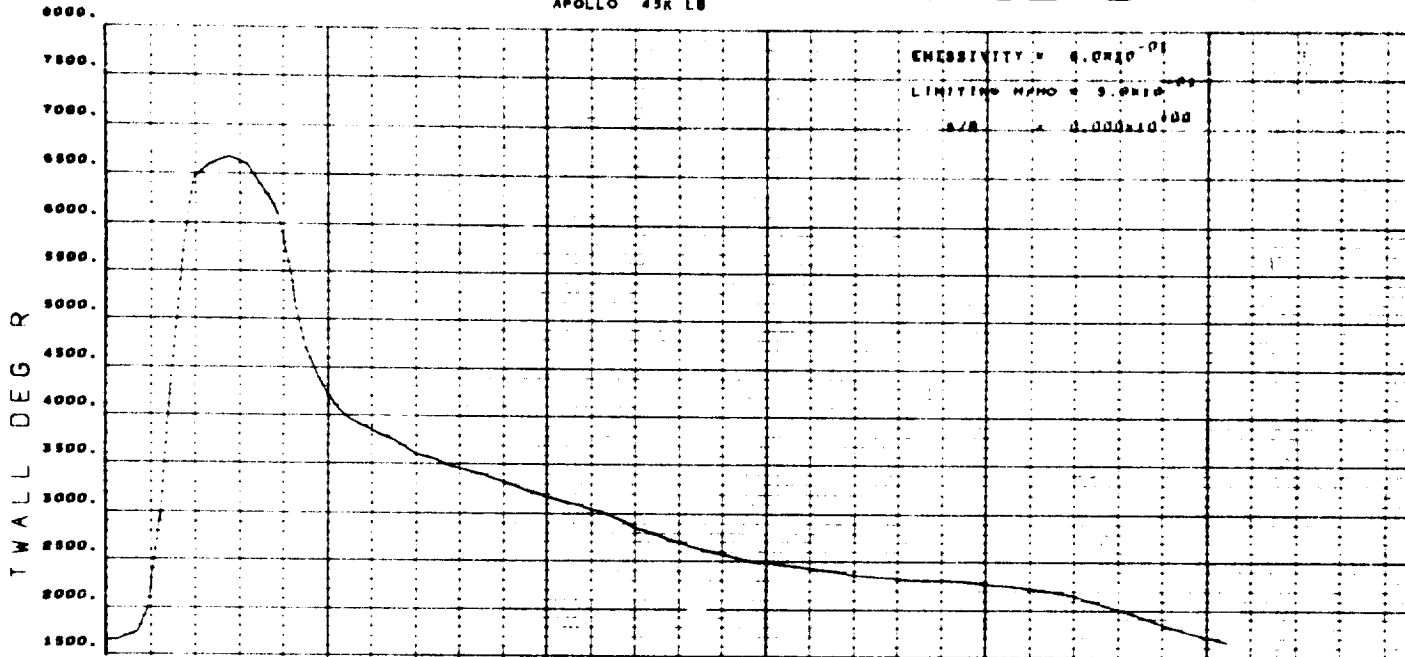


FIGURE A2

ENERGY ACCOMMODATION MECHANISMS

APOLLO 48K LB

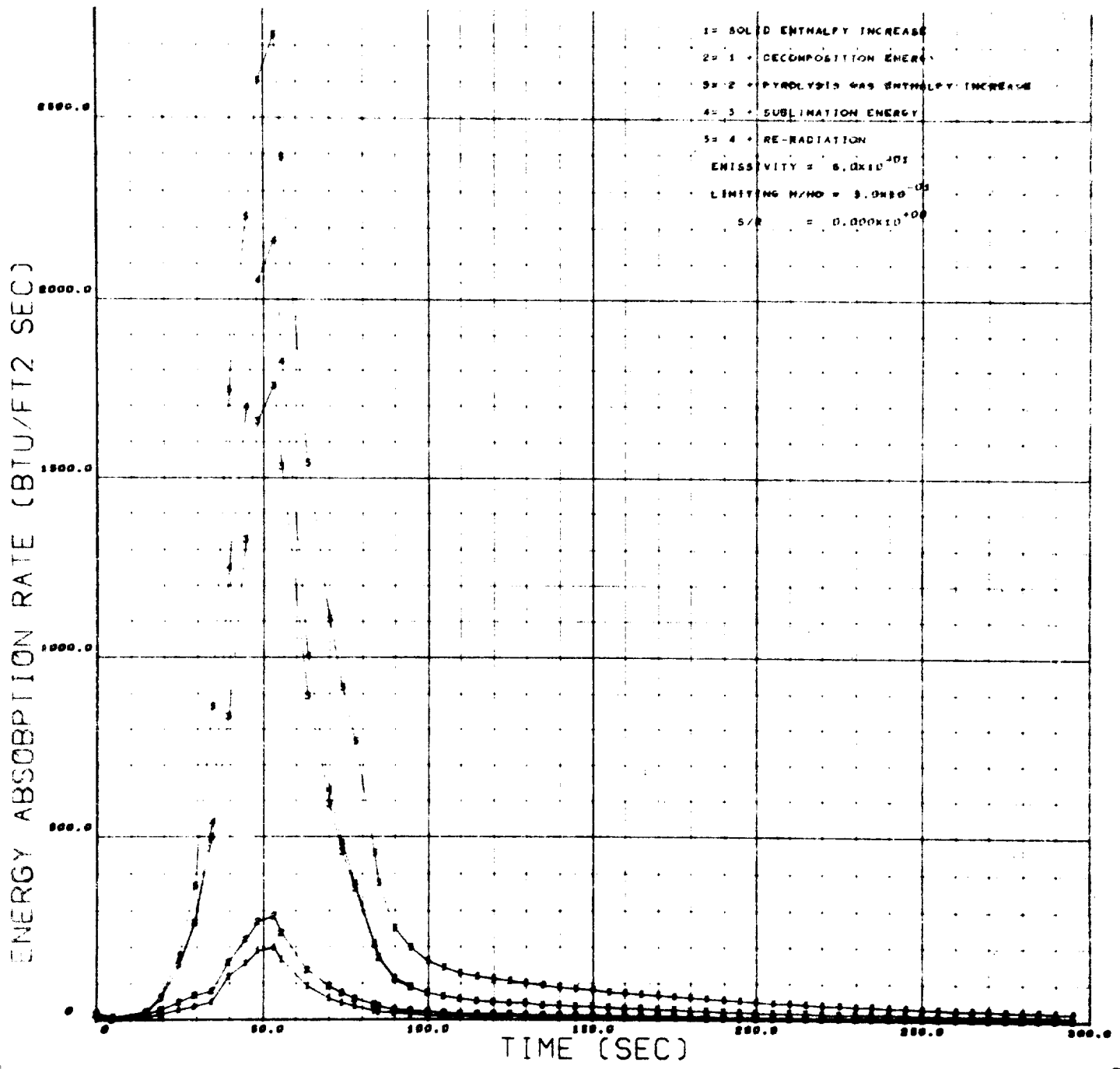


FIGURE A3

HEATING RATE HISTORY

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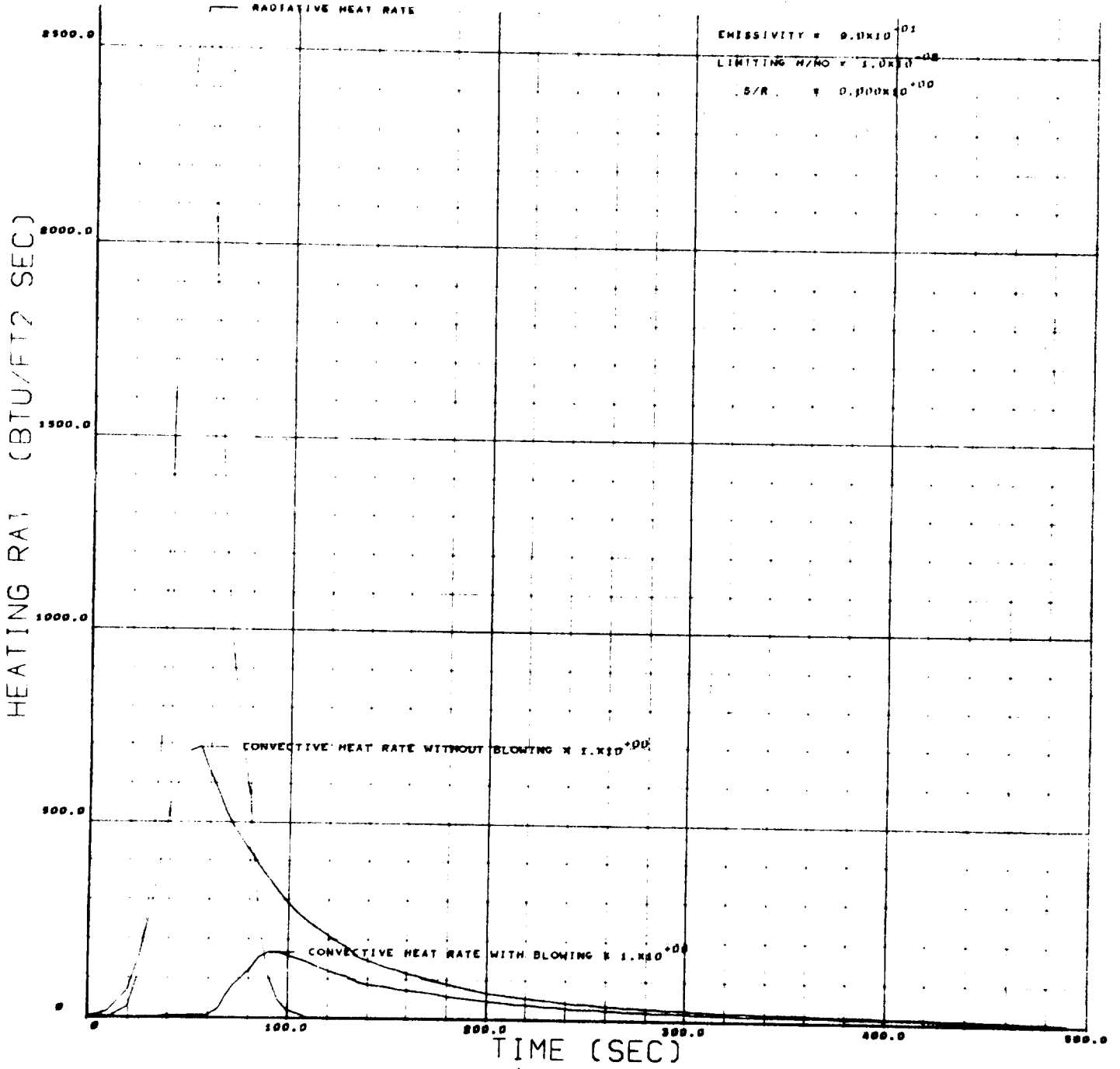


FIGURE A3

MATERIAL RESPONSE DATA

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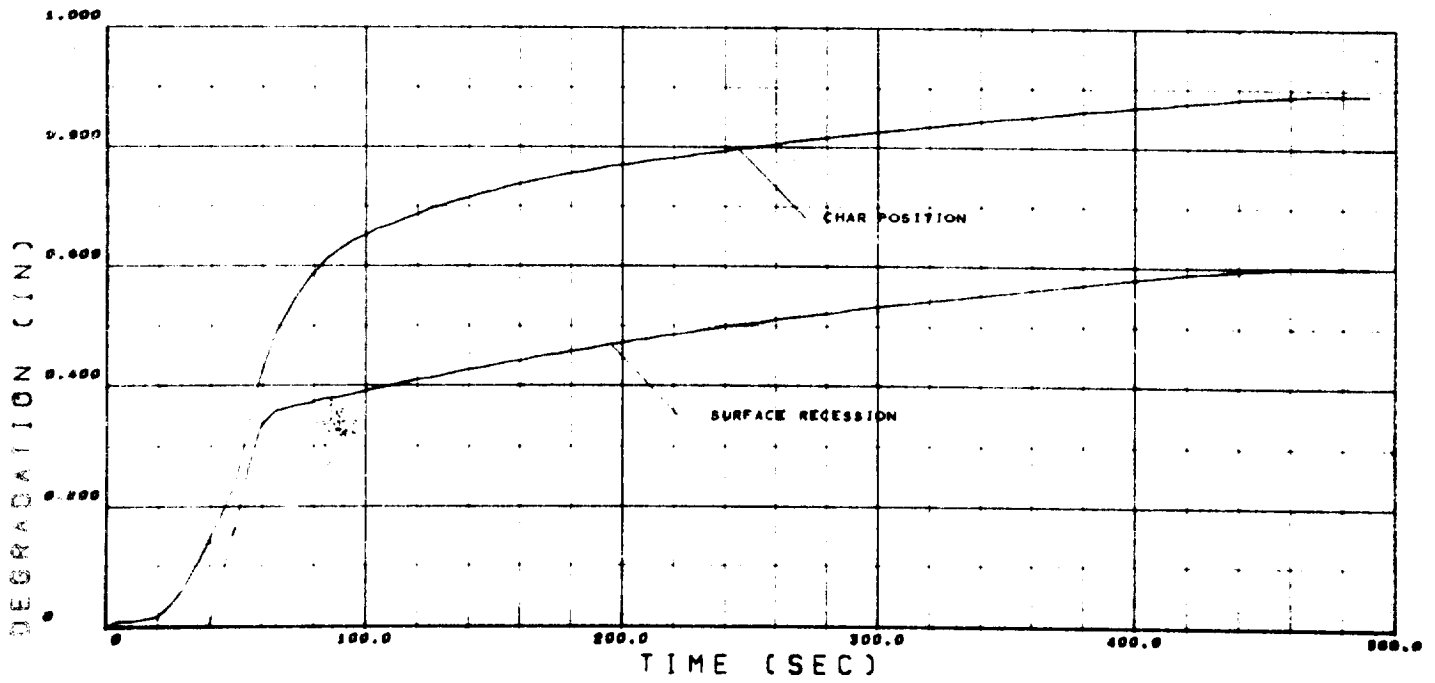
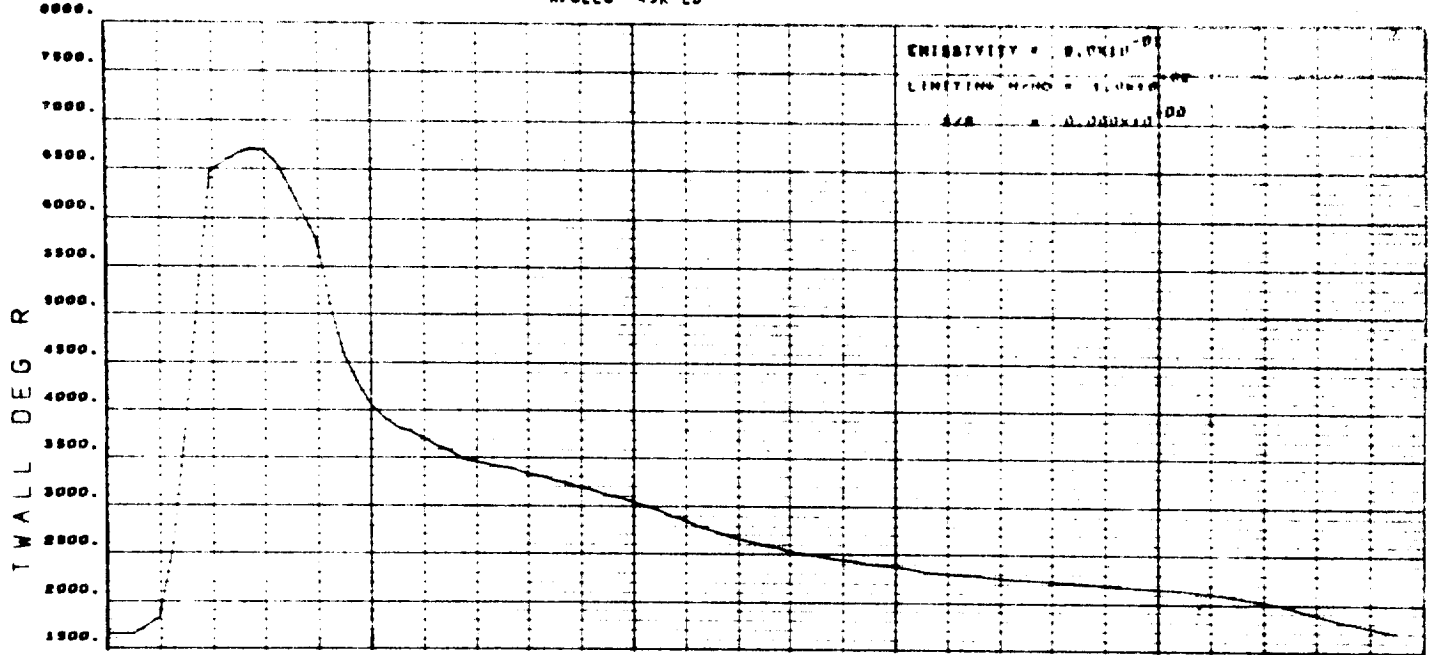


FIGURE A3

ENERGY ACCOMMODATION MECHANISMS

APOLLO 45K LB

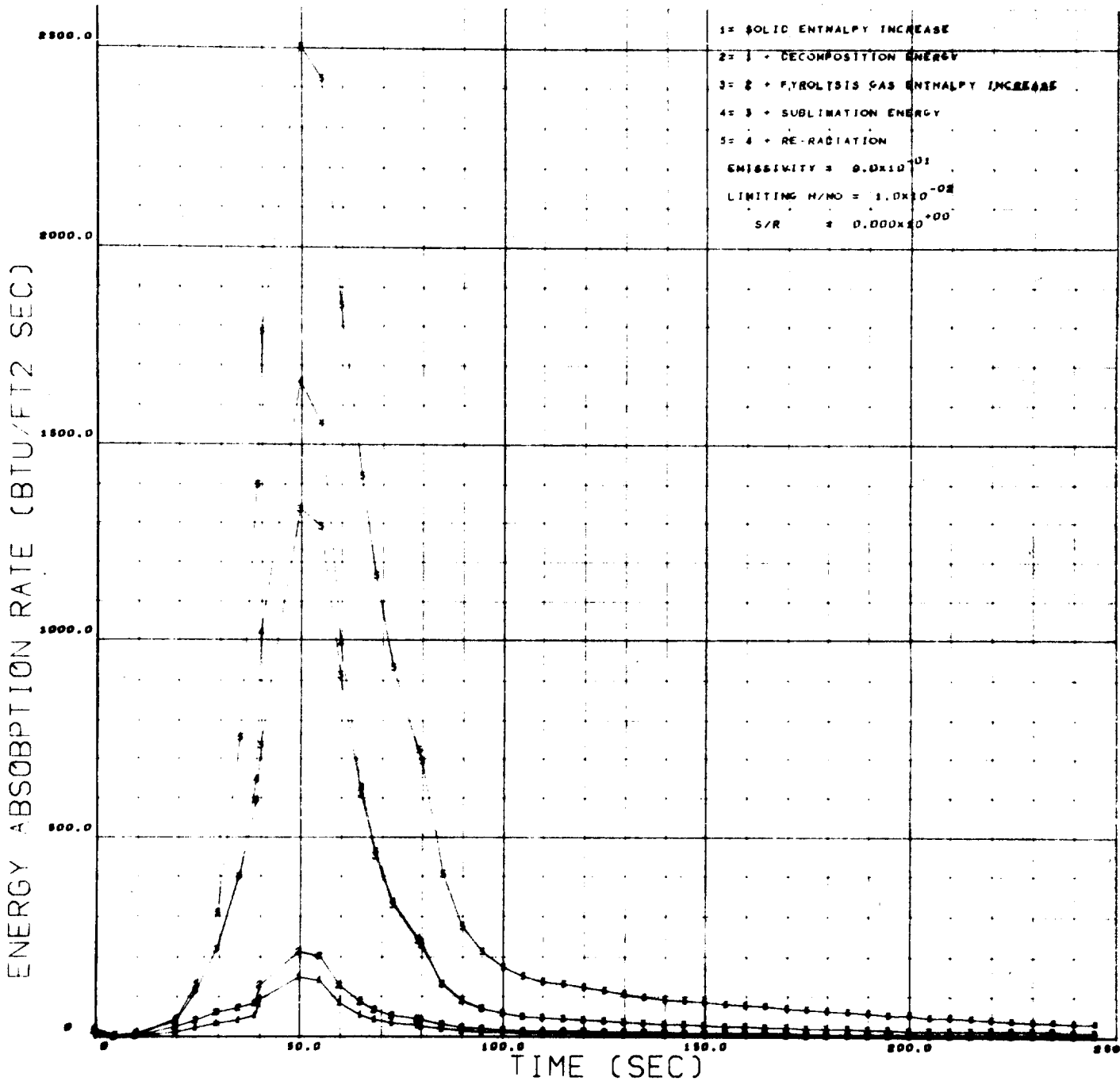


FIGURE A 4

HEATING RATE HISTORY

APOLLO 21K LB

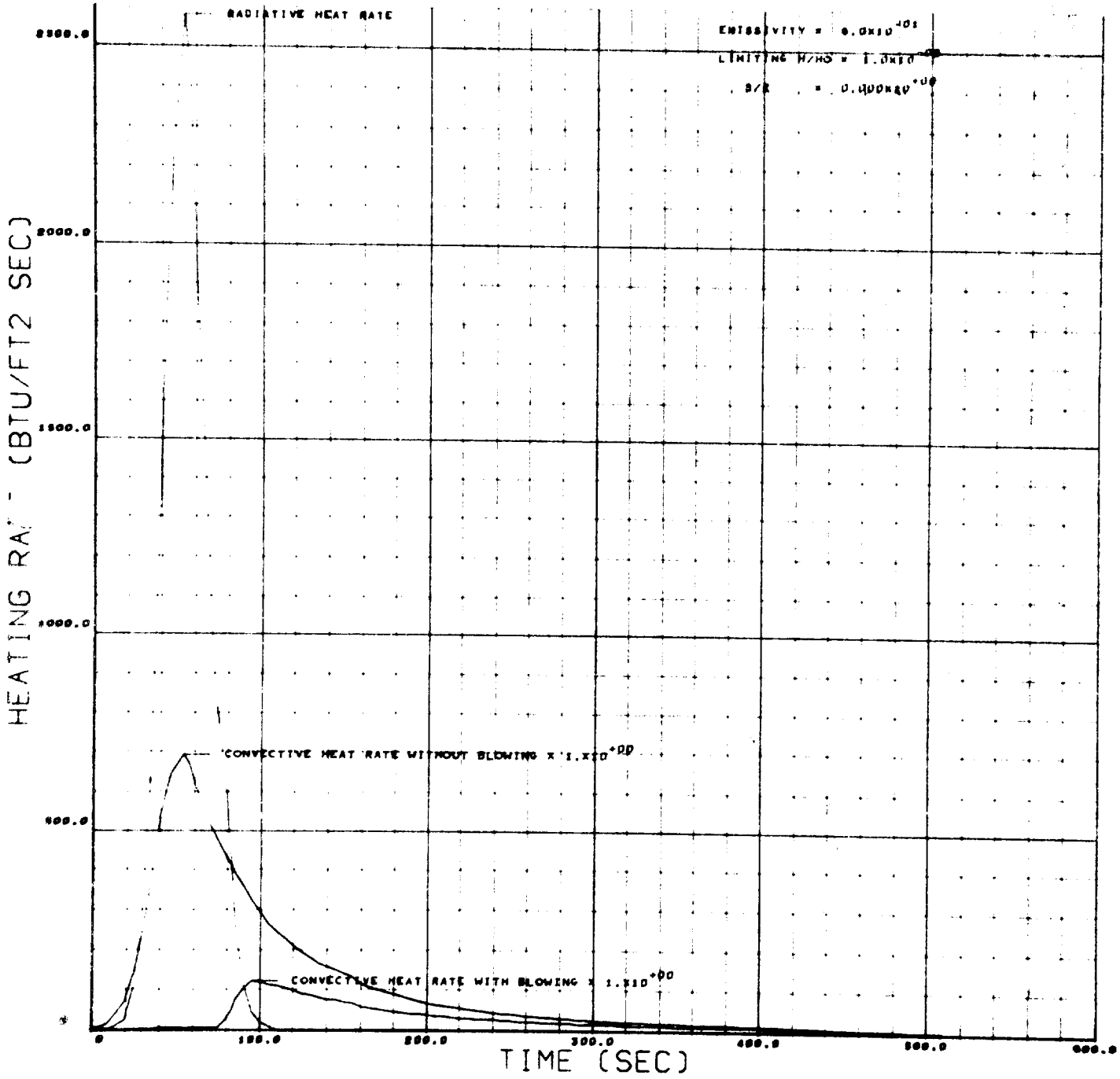


FIGURE A4

MATERIAL RESPONSE DATA

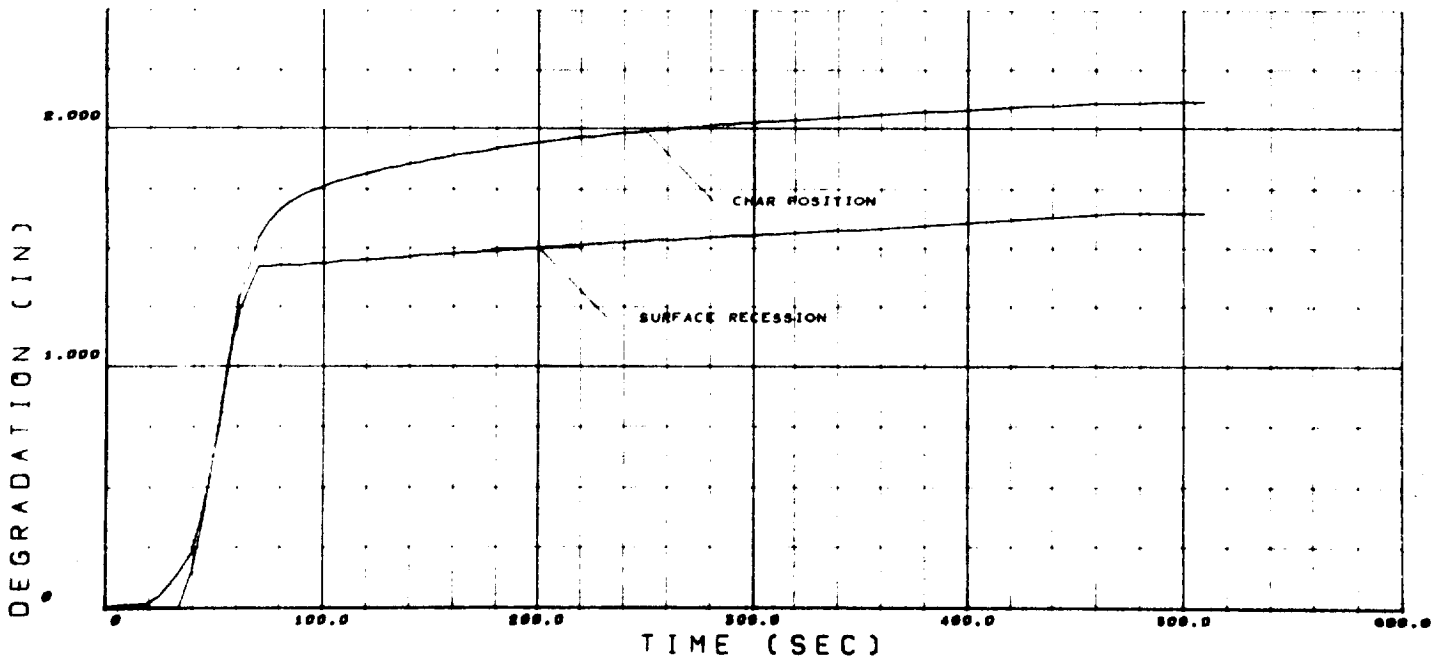
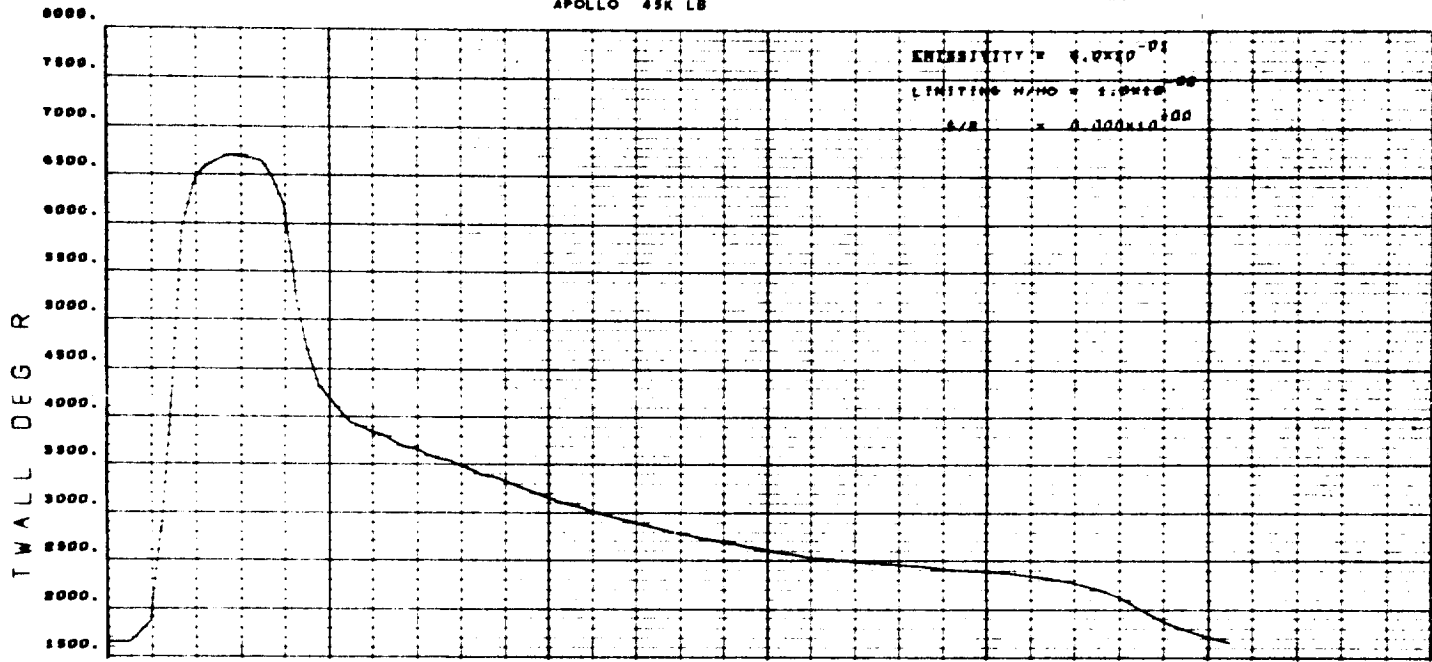


FIGURE A4

ENERGY ACCOMMODATION MECHANISMS

APOLLO 45K LB

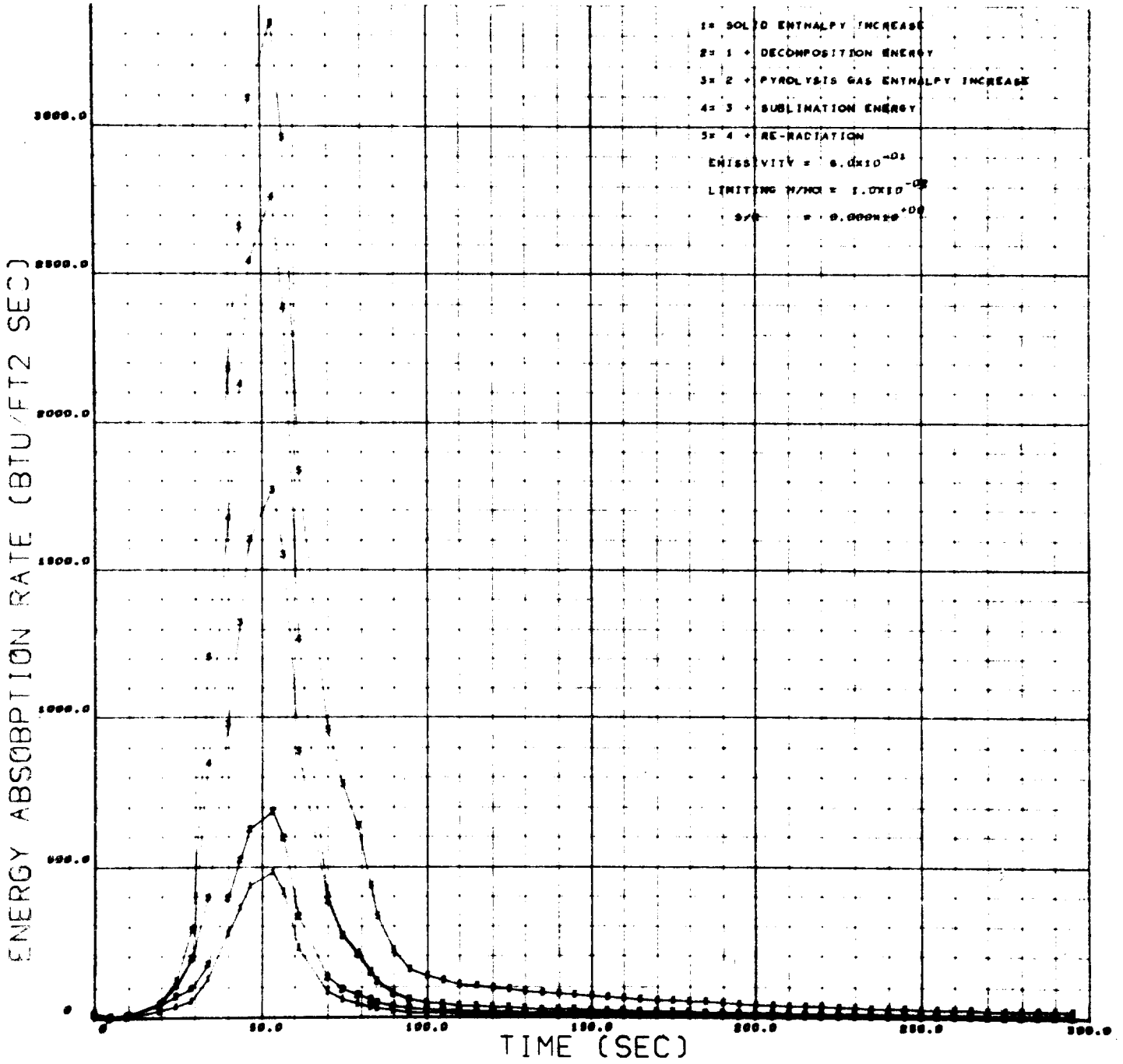


FIGURE A5

HEATING RATE HISTORY

APOLLO 7TK LB

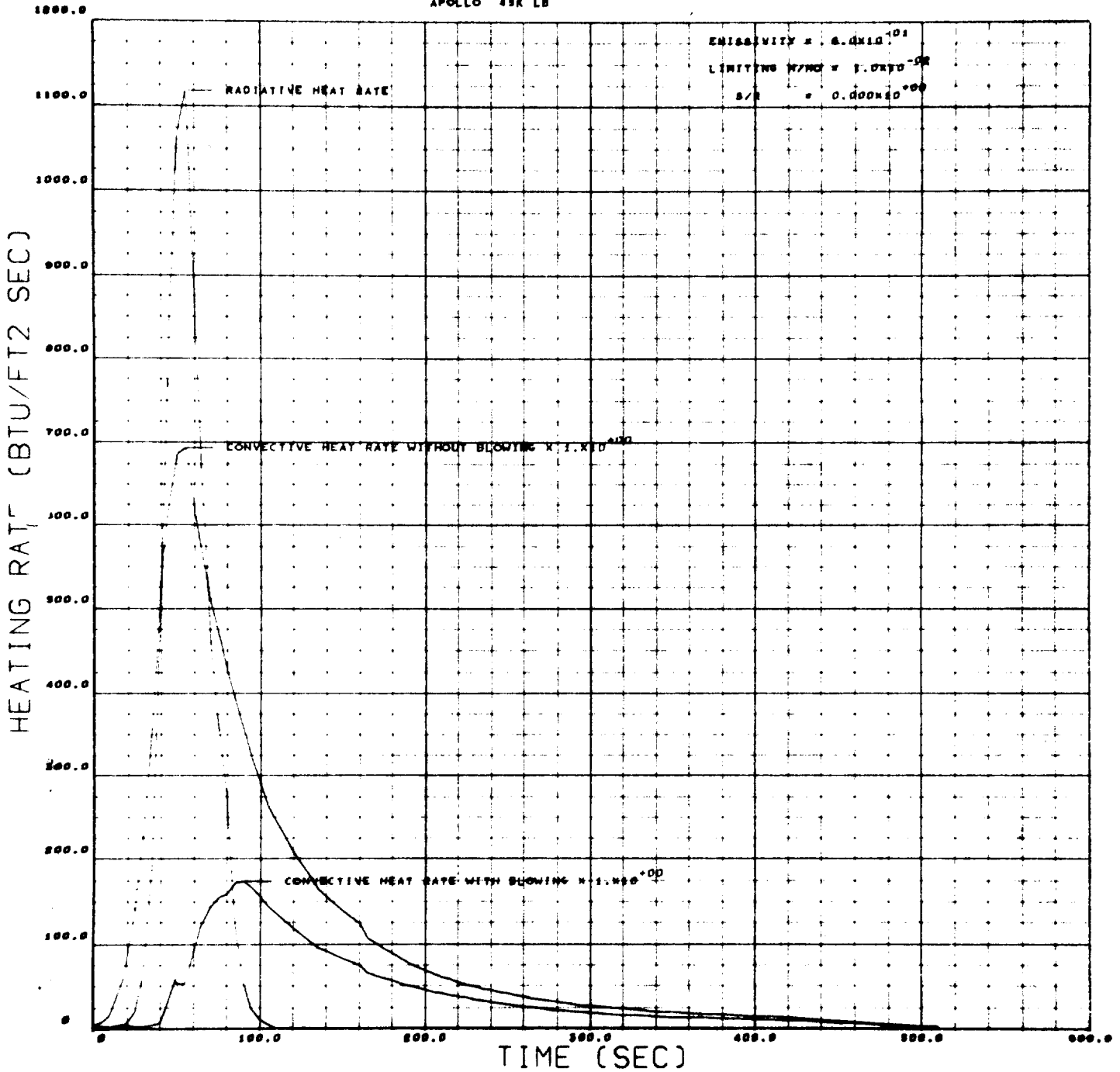


FIGURE A5

ENERGY ACCOMMODATION MECHANISMS

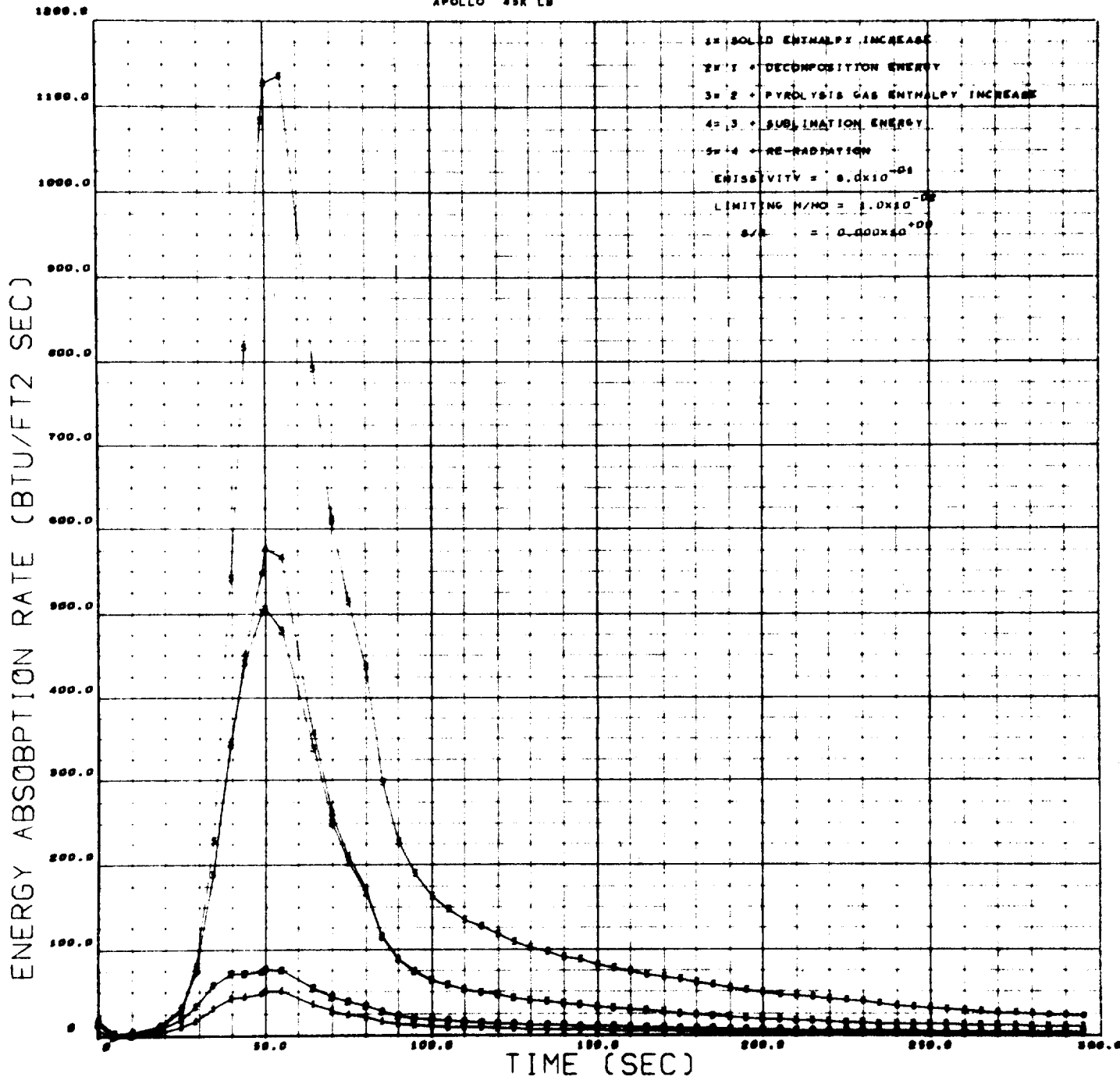


FIGURE A6

HEATING RATE HISTORY

APOLLO 78K LB

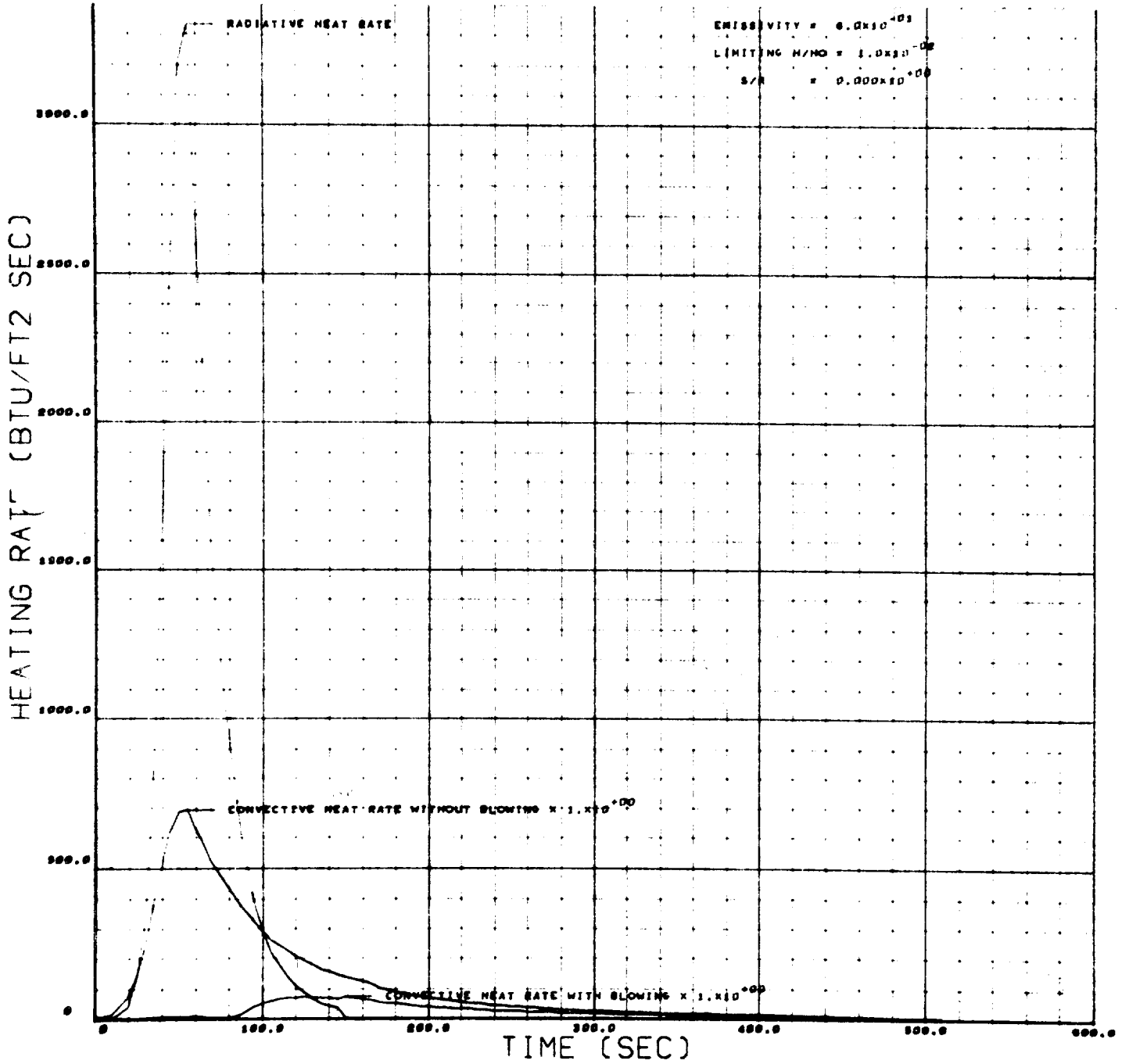


FIGURE A6

MATERIAL RESPONSE DATA

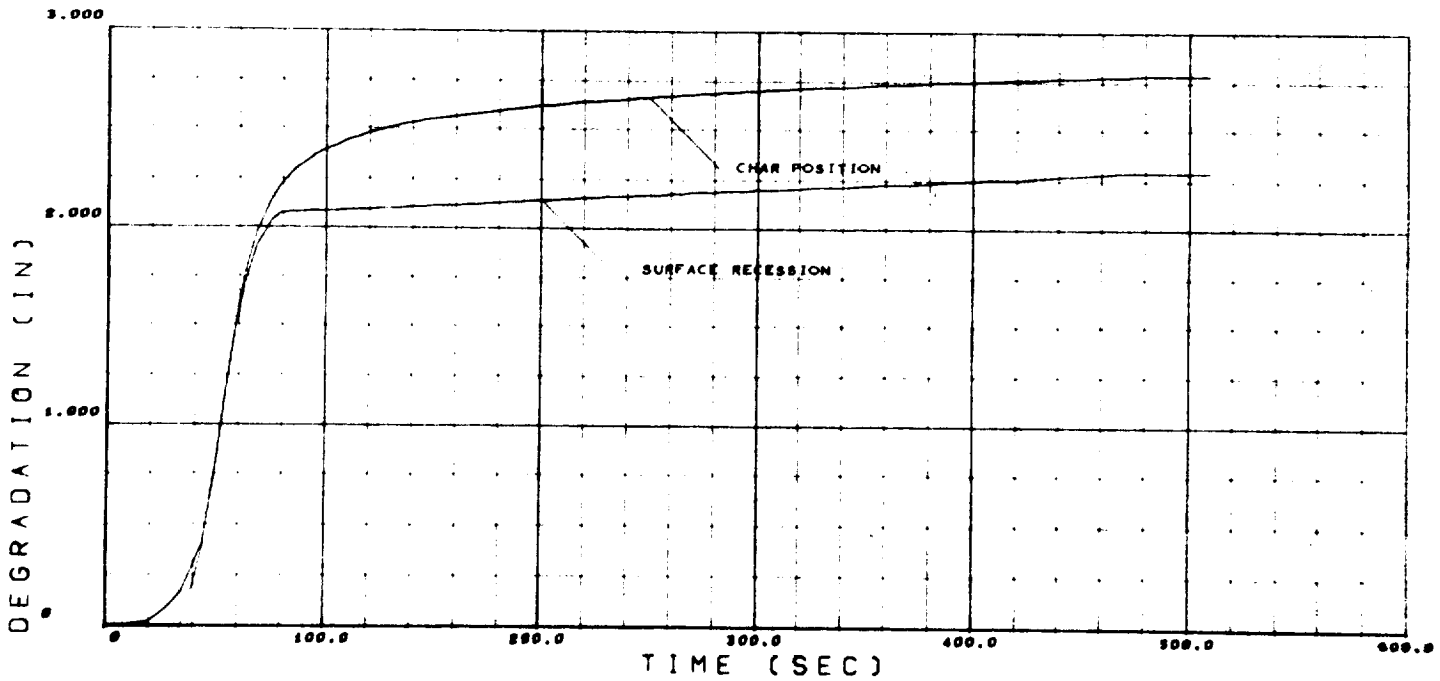
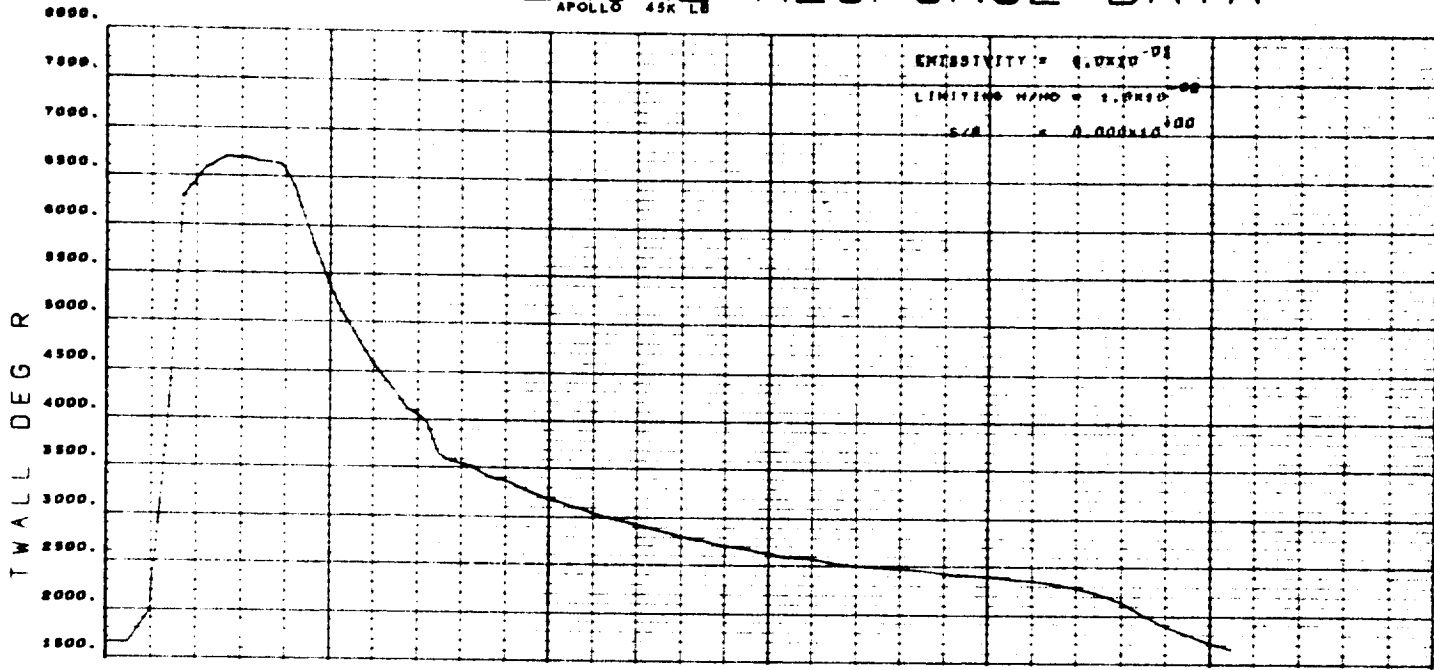


FIGURE A6

ENERGY ACCOMMODATION MECHANISMS

APOLLO 71K LB

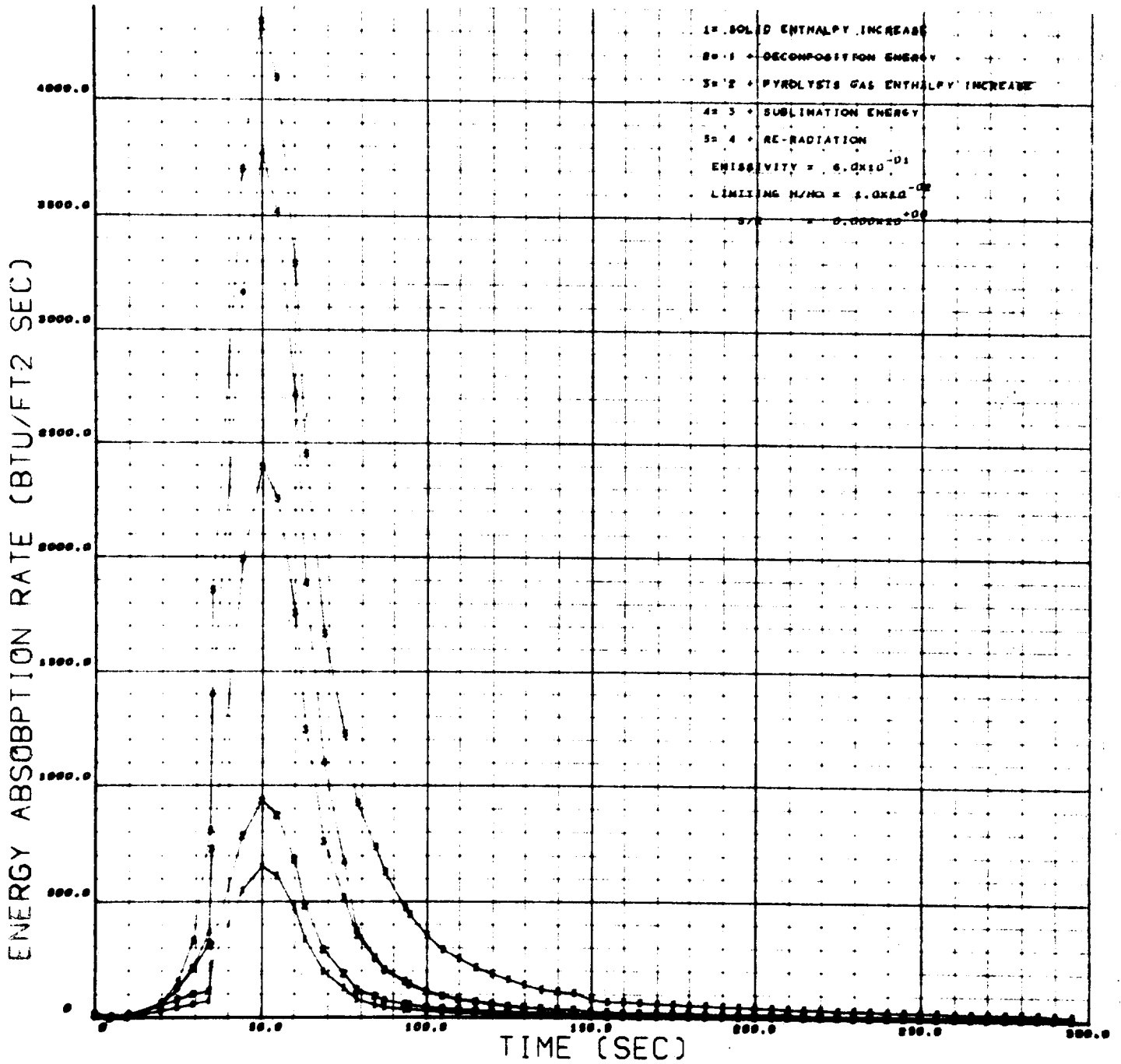


FIGURE A7

HEATING RATE HISTORY

APOLLO 15K LB

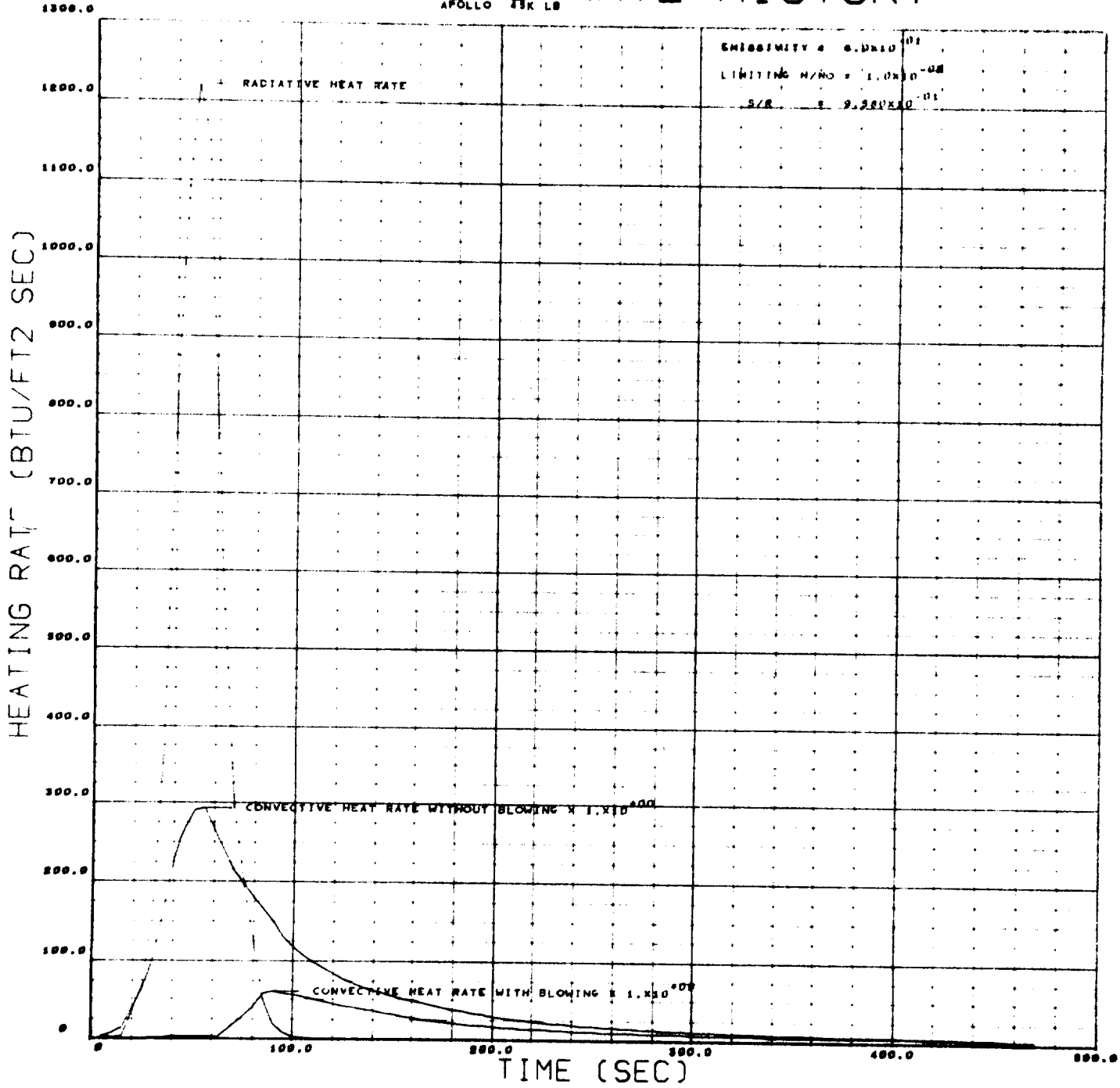


FIGURE A7

MATERIAL RESPONSE DATA

APOLLO 45K LB

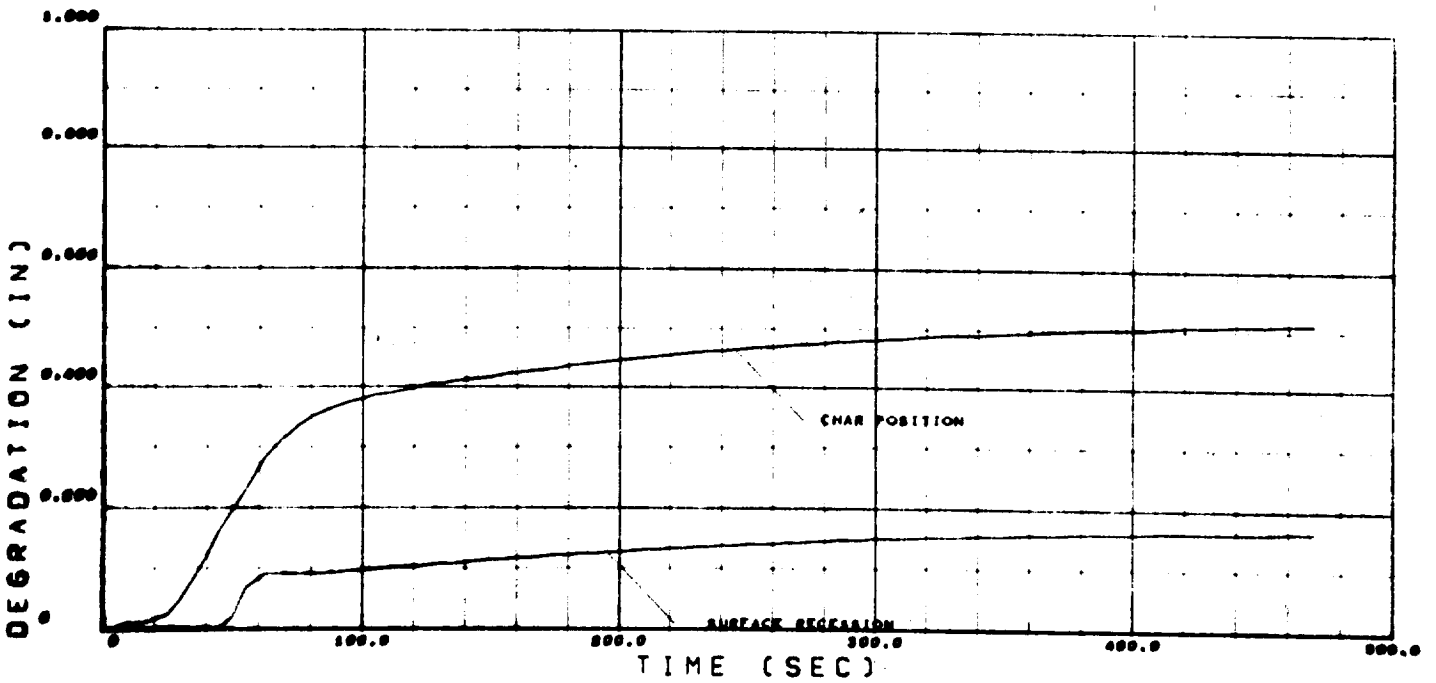
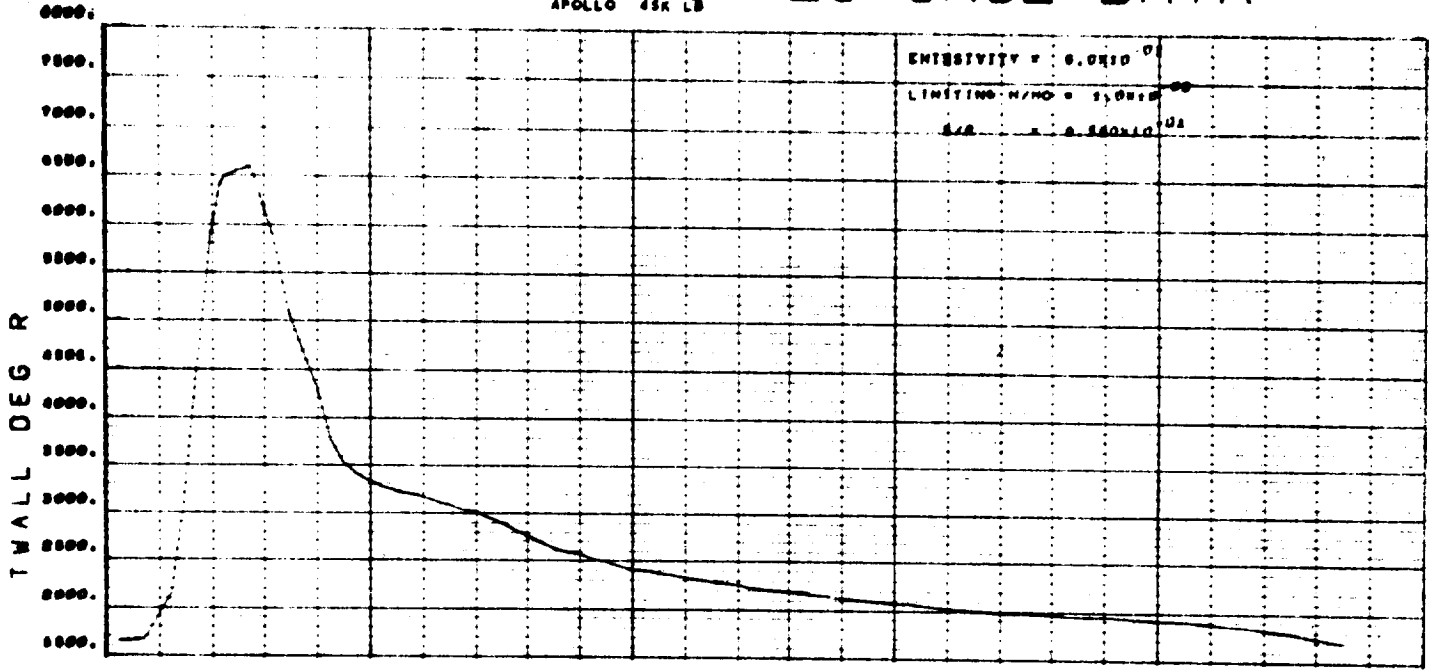


FIGURE A7

ENERGY ACCOMMODATION MECHANISMS

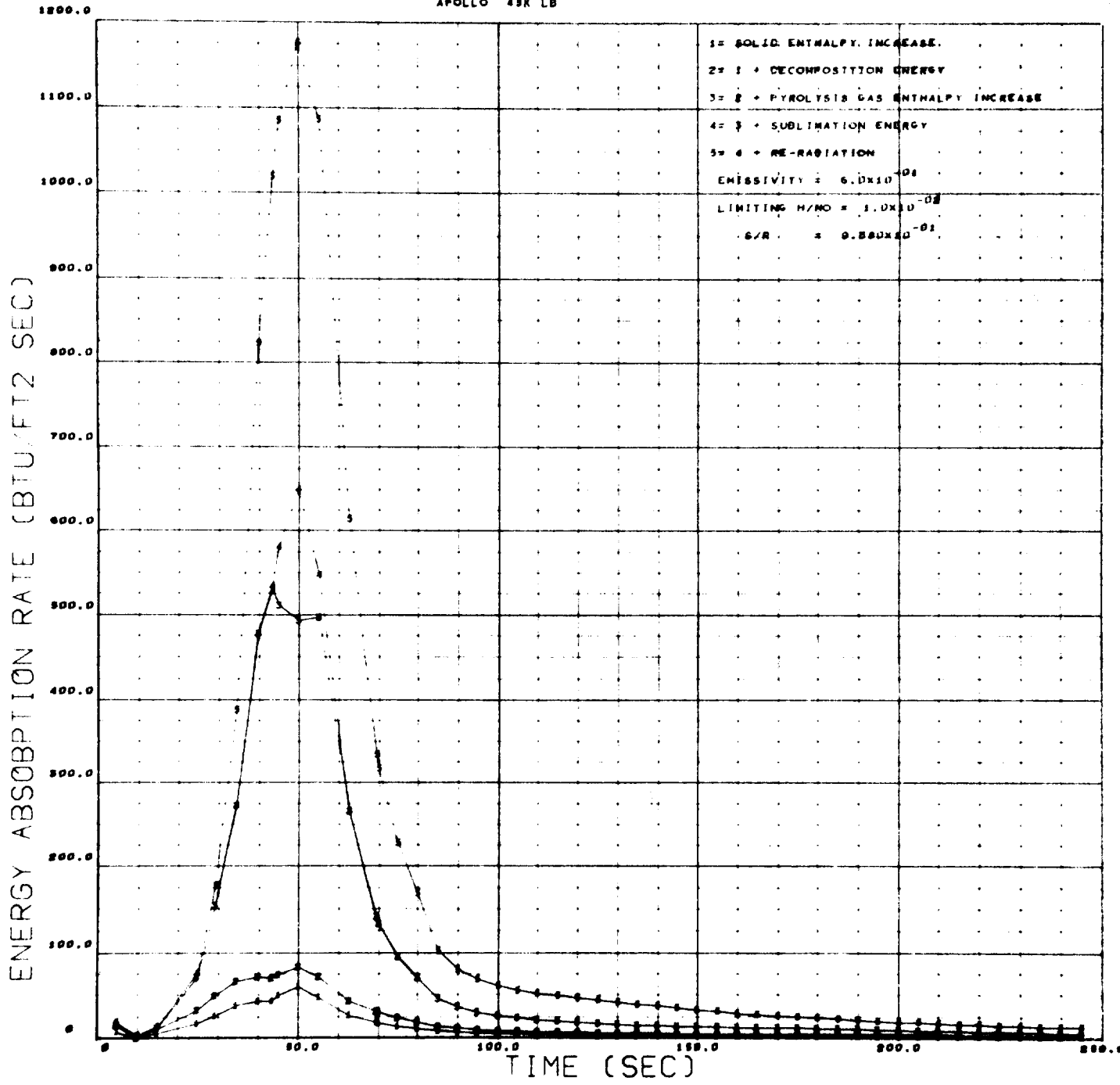


FIGURE A8

HEATING RATE HISTORY

APOLLO 45K LB

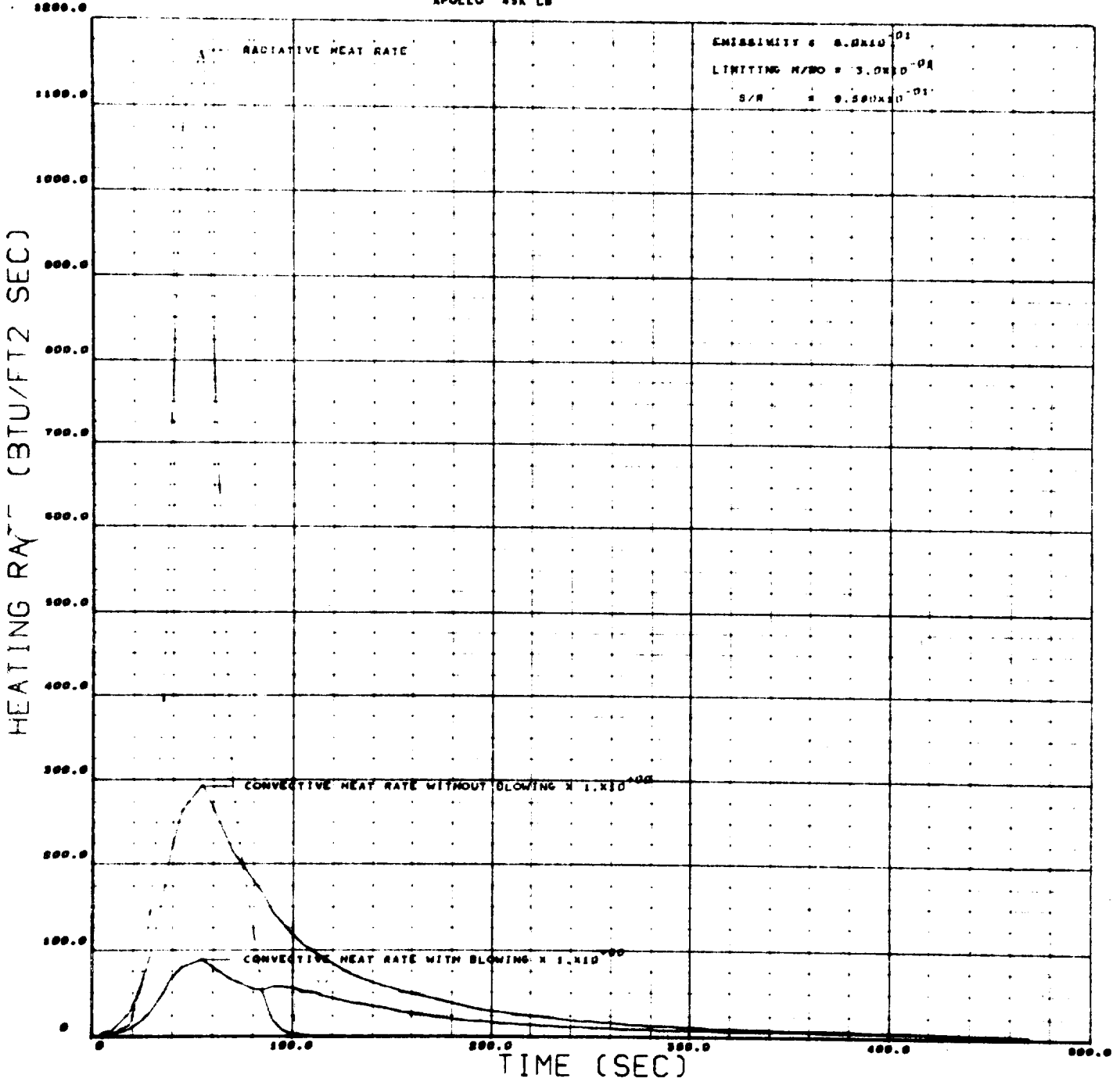


FIGURE A8

MATERIAL RESPONSE DATA

APOLLO 49K LB

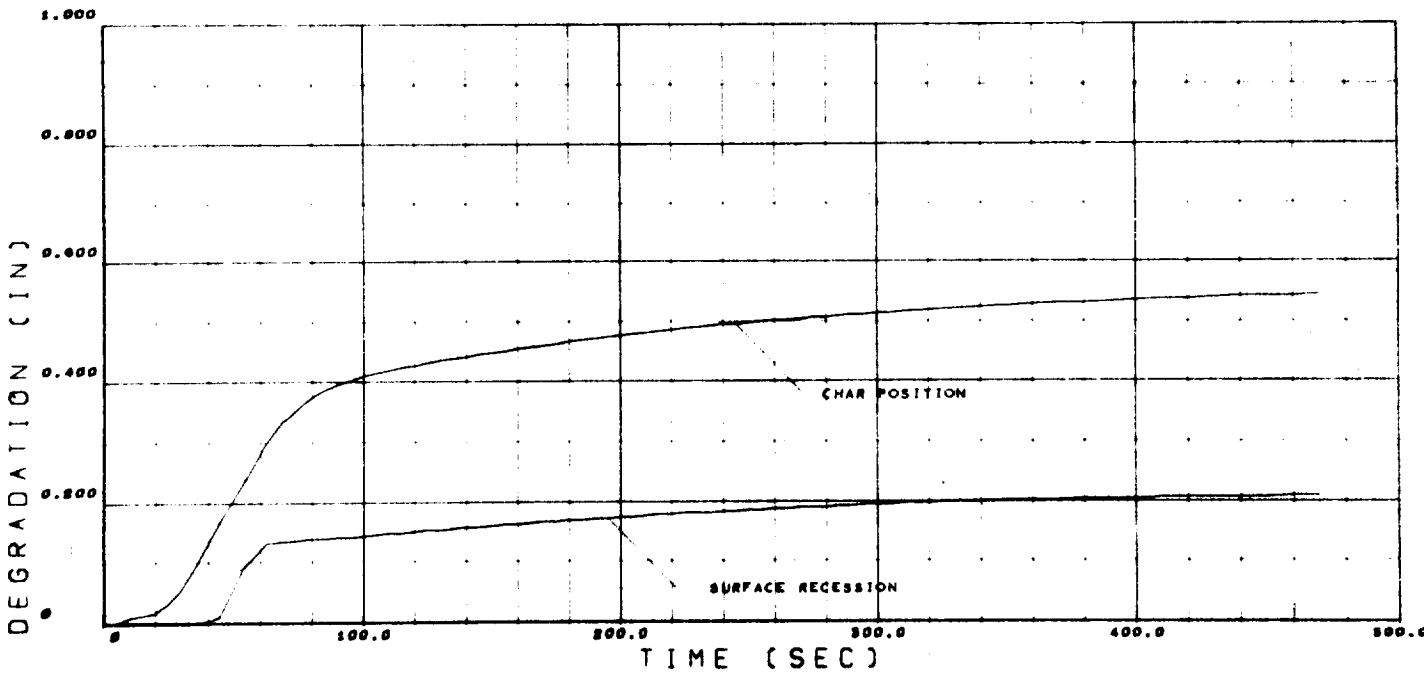
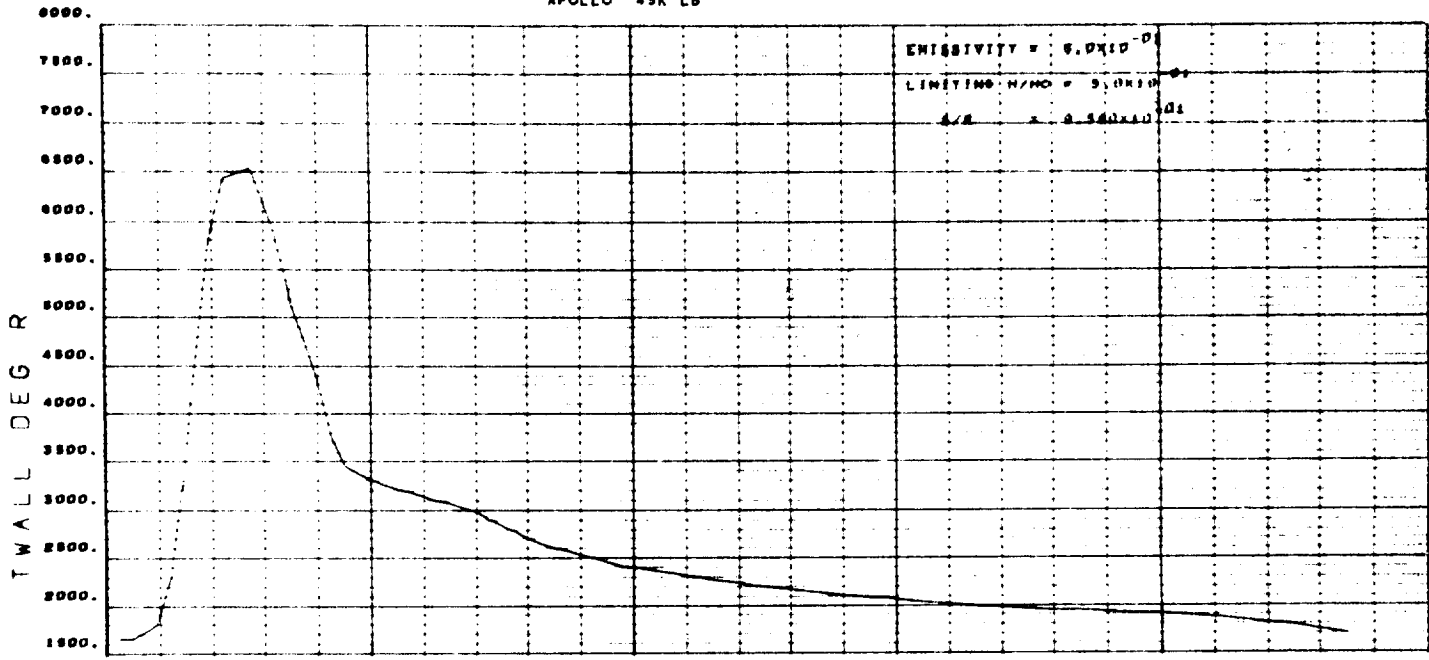


FIGURE A8

ENERGY ACCOMMODATION MECHANISMS

APOLLO 45K LB

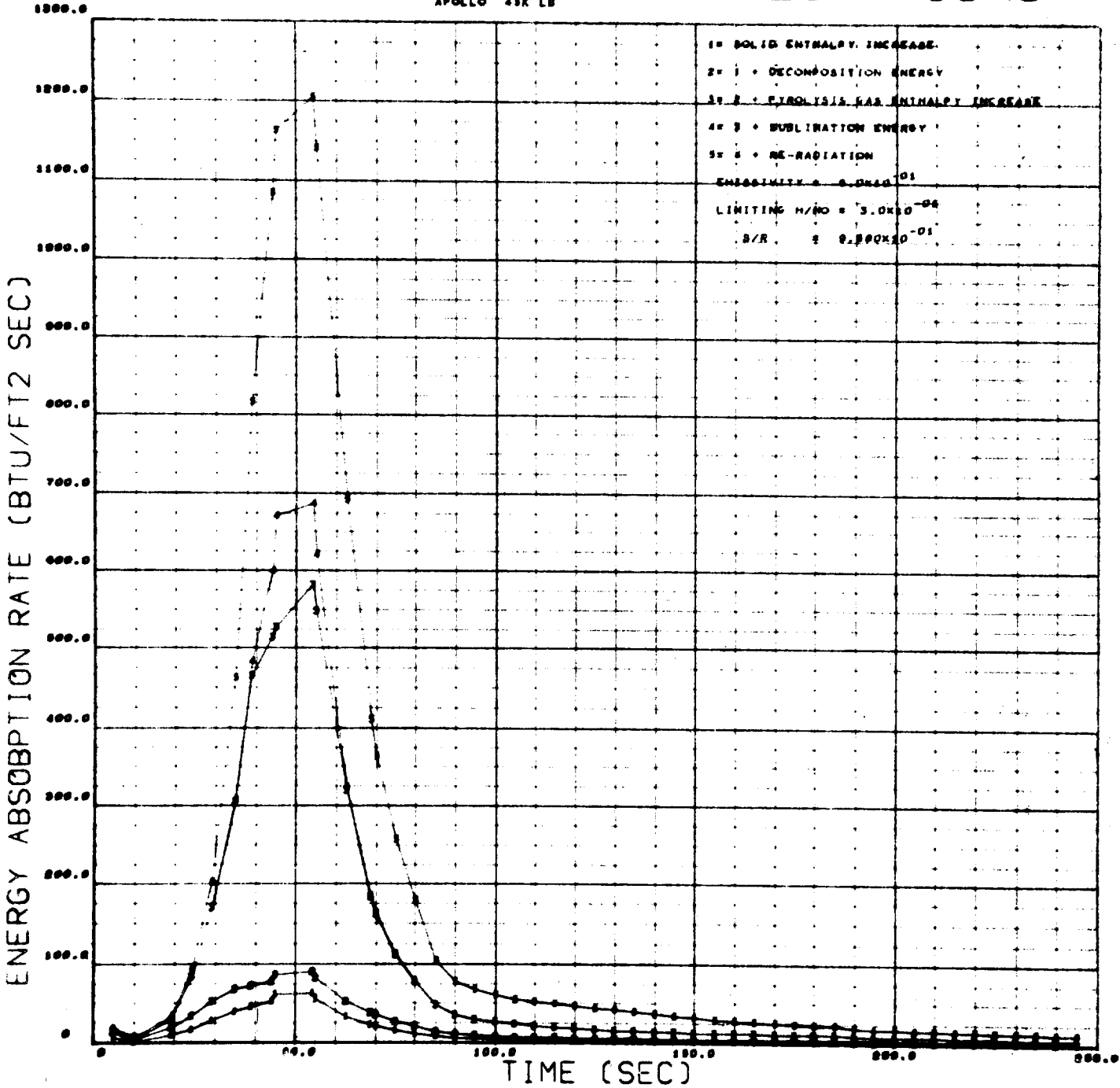


FIGURE A9

HEATING RATE HISTORY

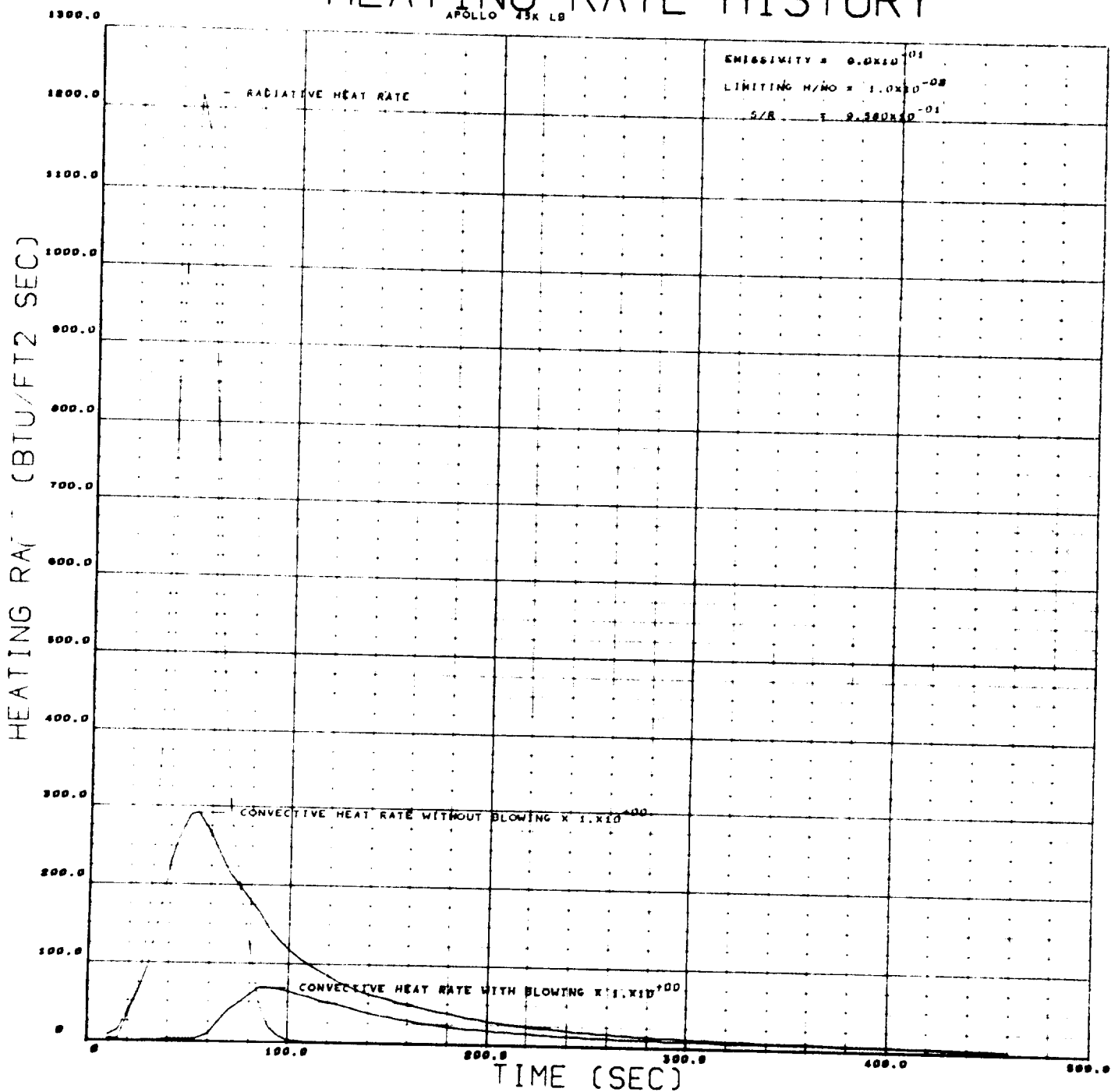


FIGURE A9

MATERIAL RESPONSE DATA

APOLLO 43K LB

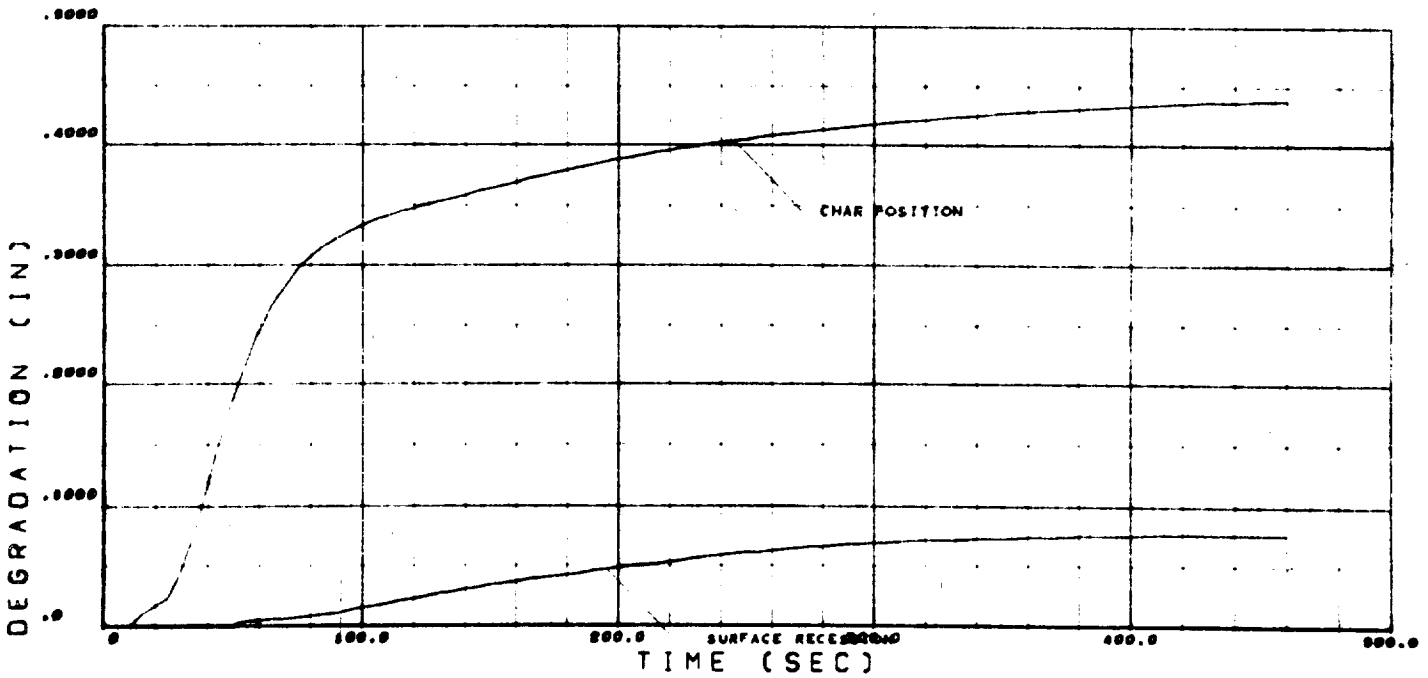
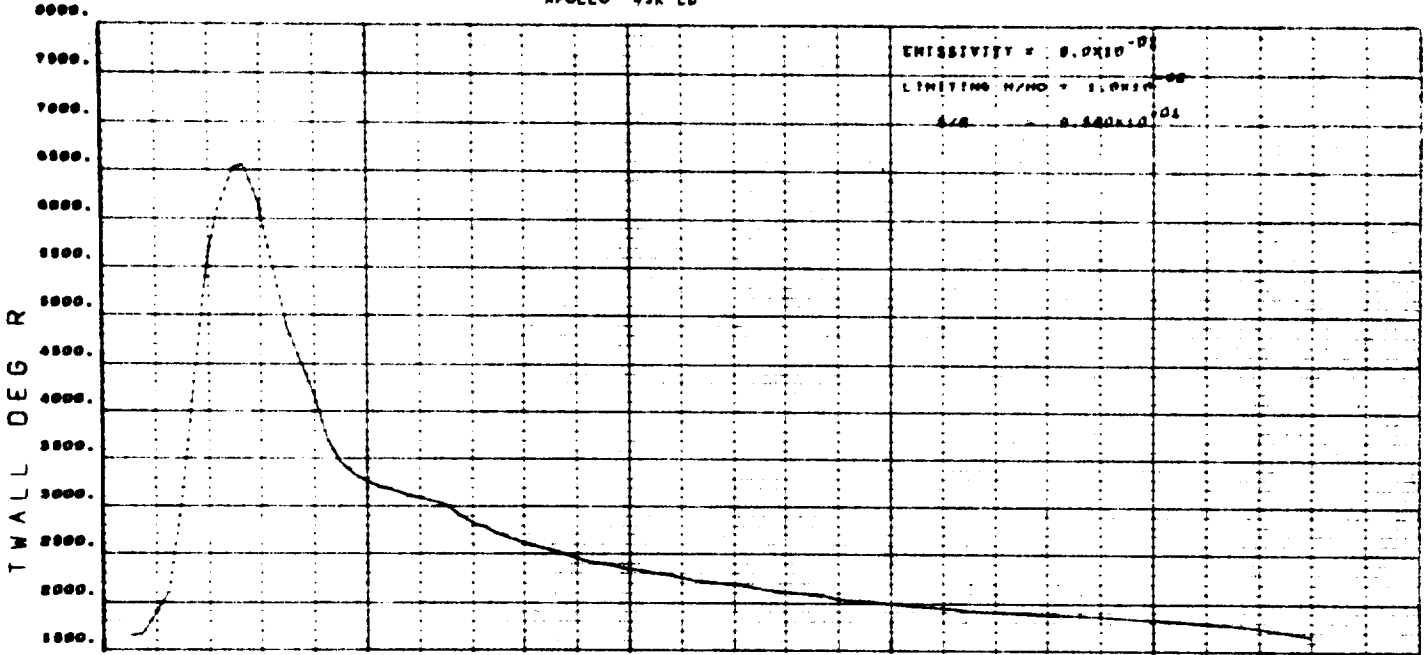


FIGURE A9

ENERGY ACCOMMODATION MECHANISMS

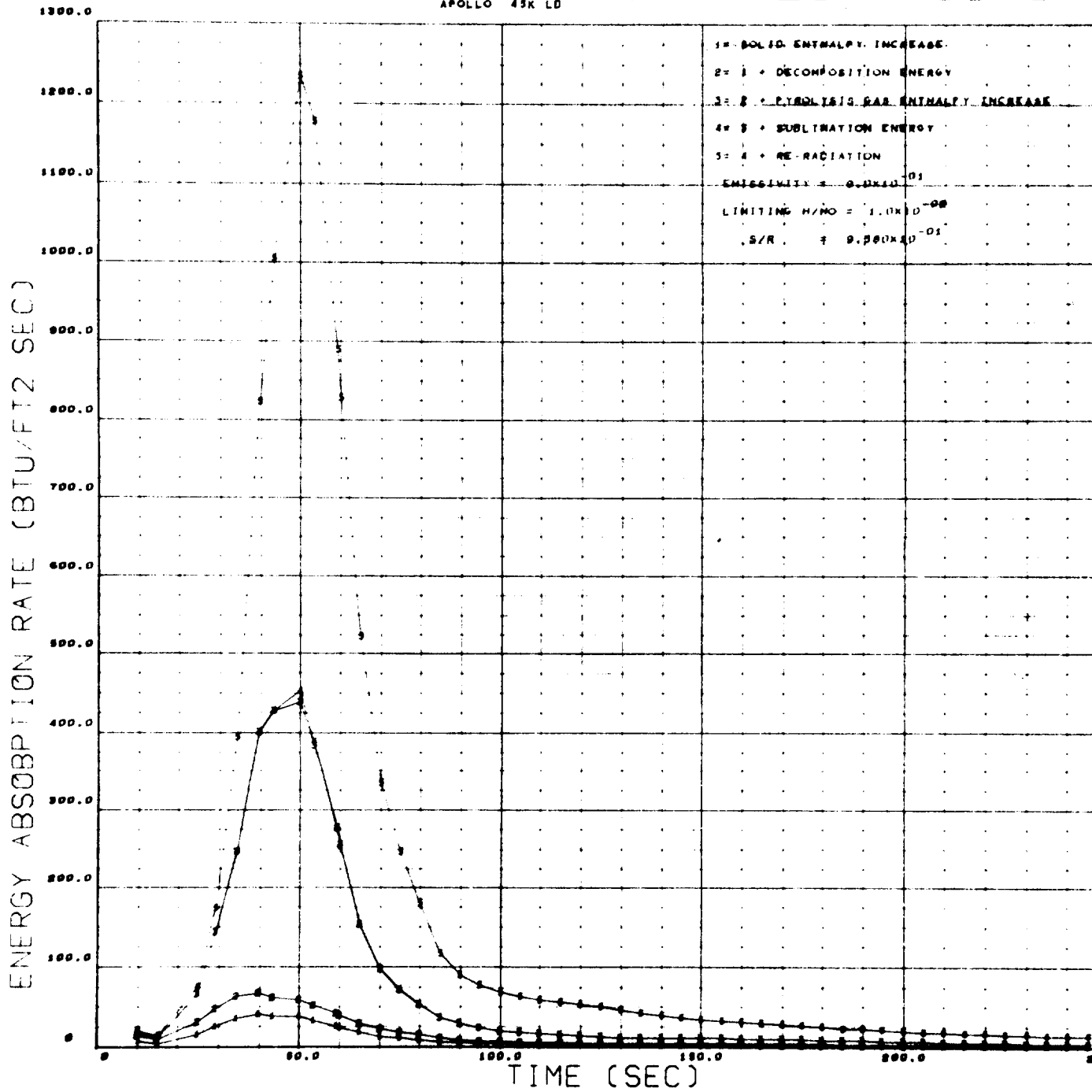


FIGURE A 10

HEATING RATE HISTORY

APOLLO 31K LB

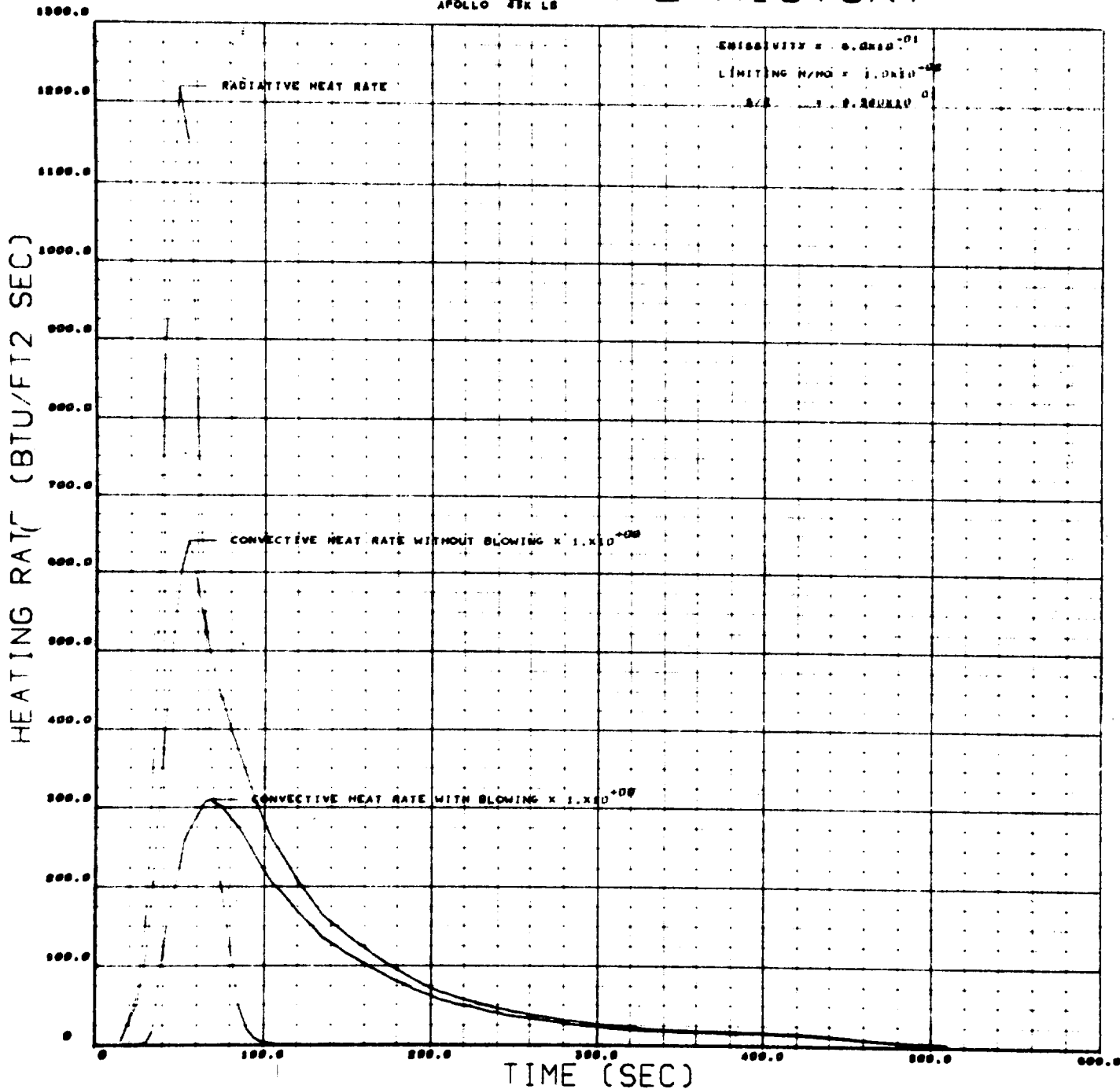


FIGURE A10

MATERIAL RESPONSE DATA

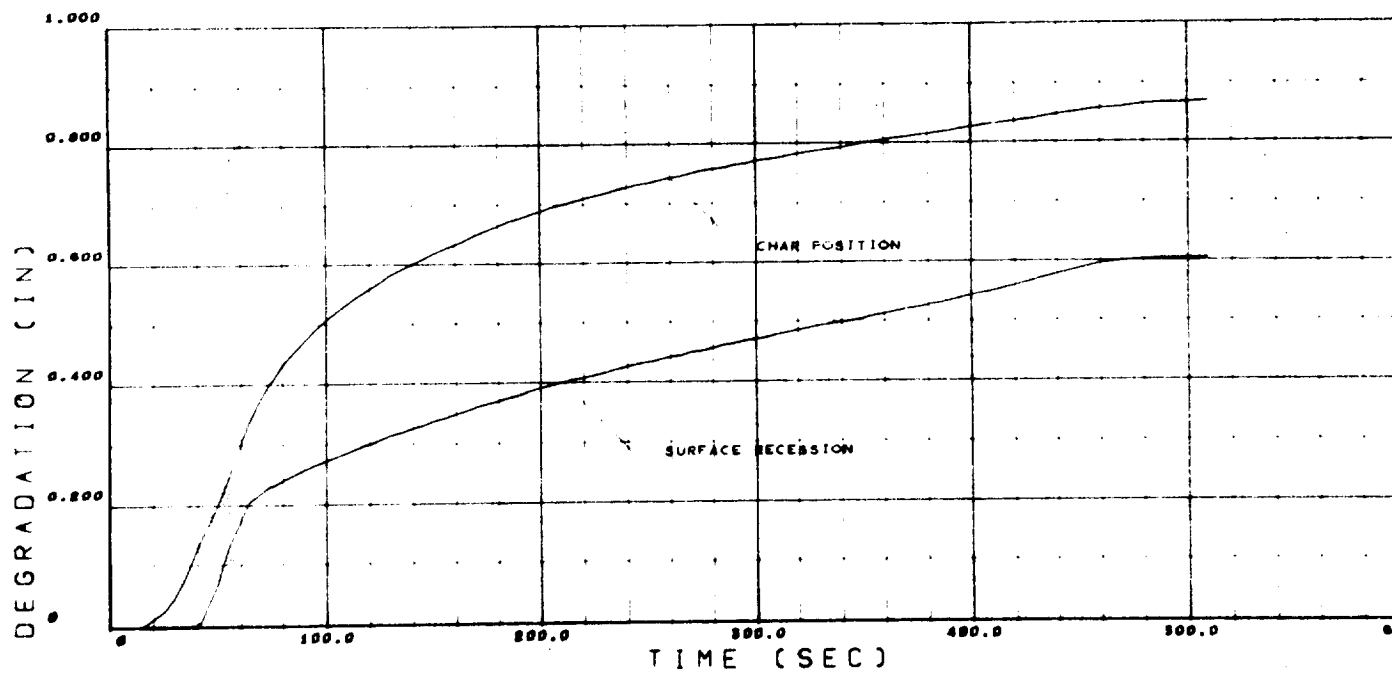
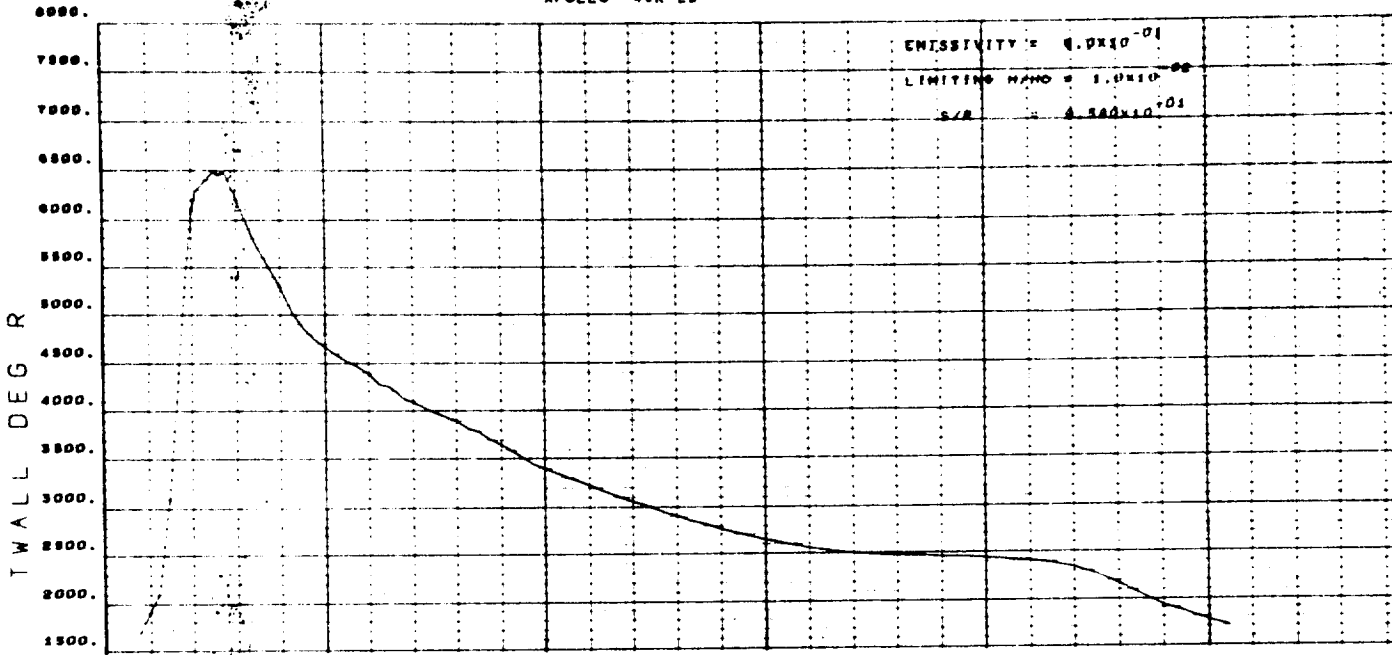


FIGURE A 10

ENERGY ACCOMMODATION MECHANISMS

APOLLO 75M LB

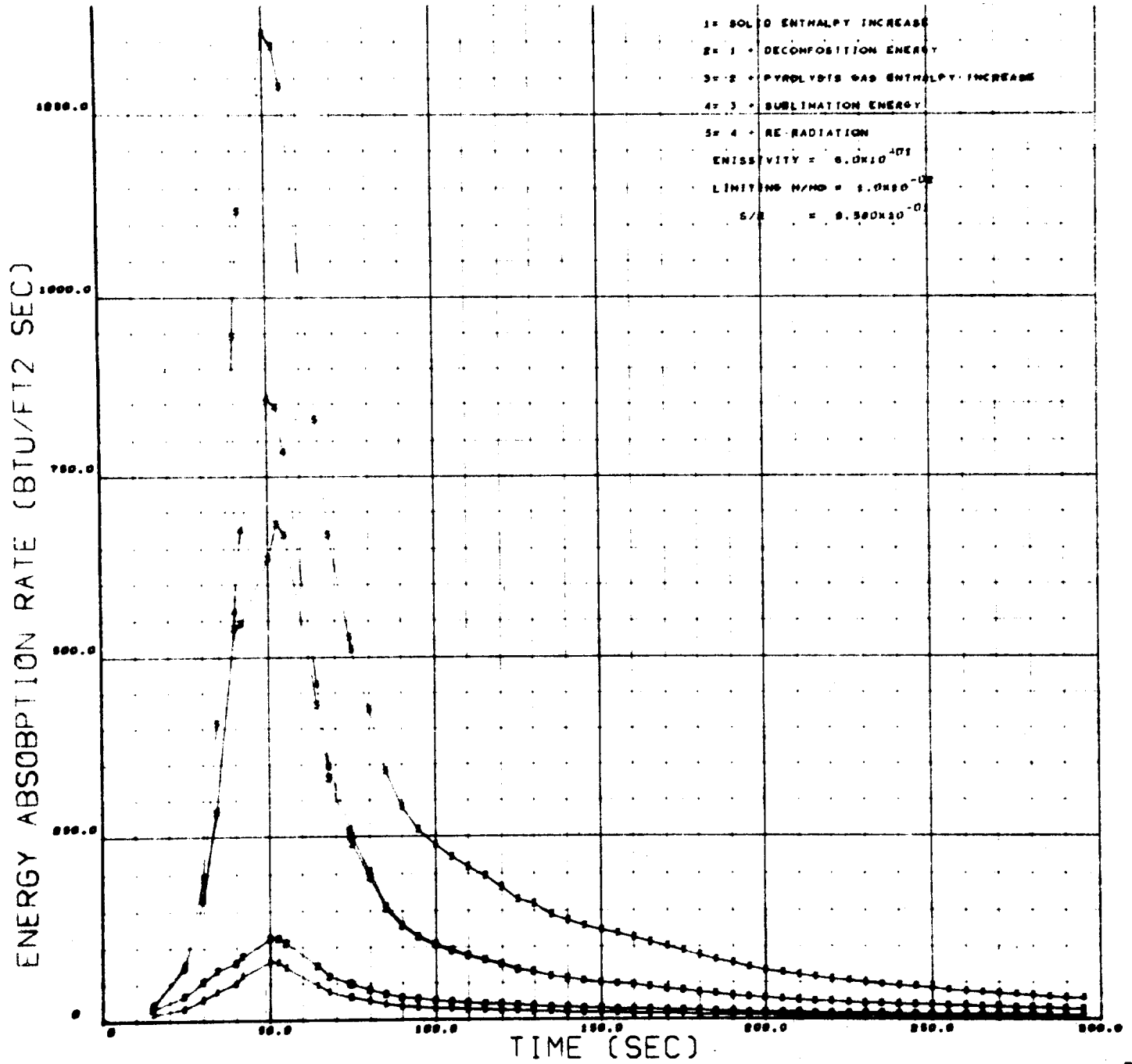


FIGURE A 11

HEATING RATE HISTORY

APOLLO 45K LB

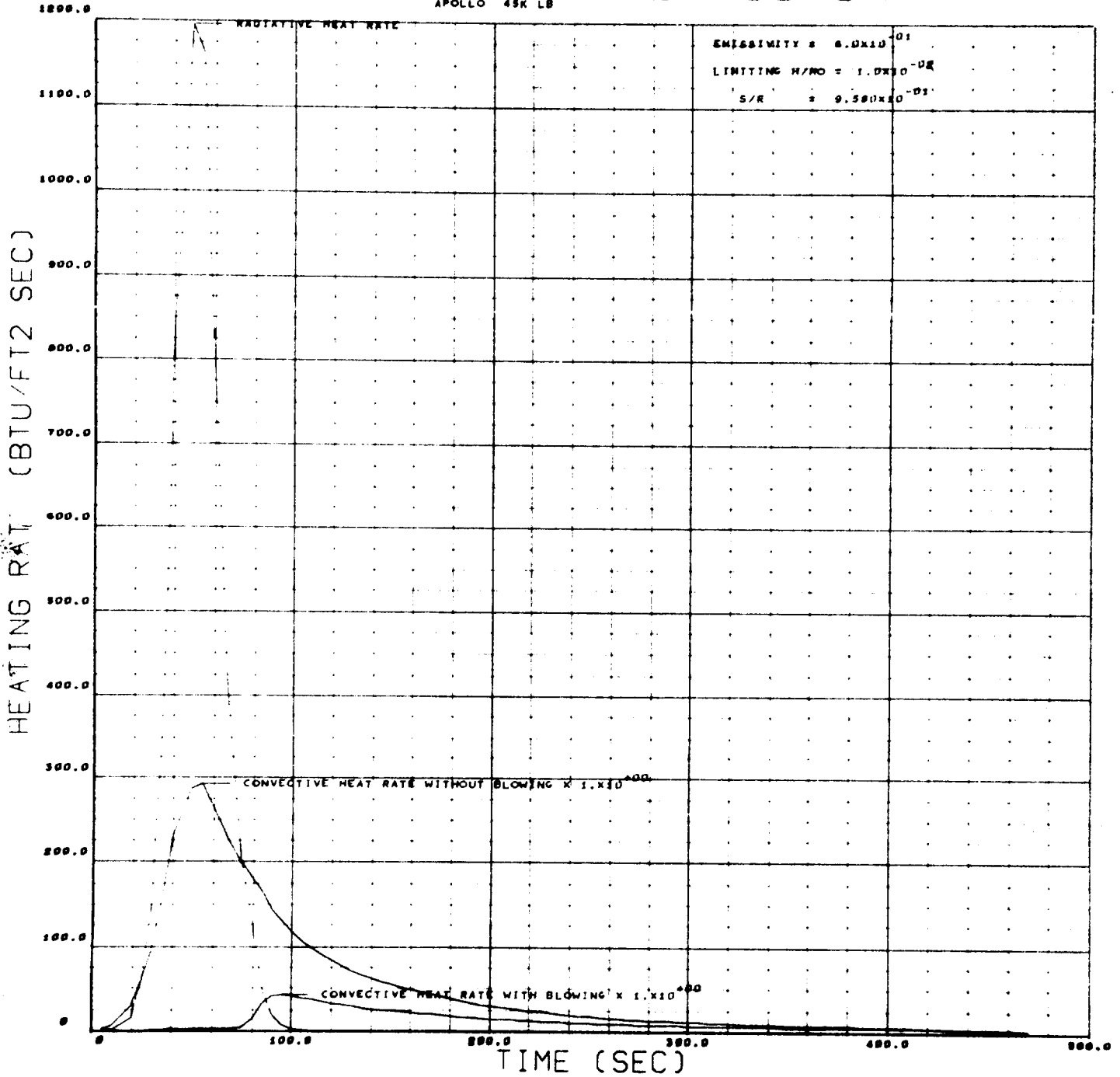


FIGURE A 11

MATERIAL RESPONSE DATA

APOLLO 45K LB

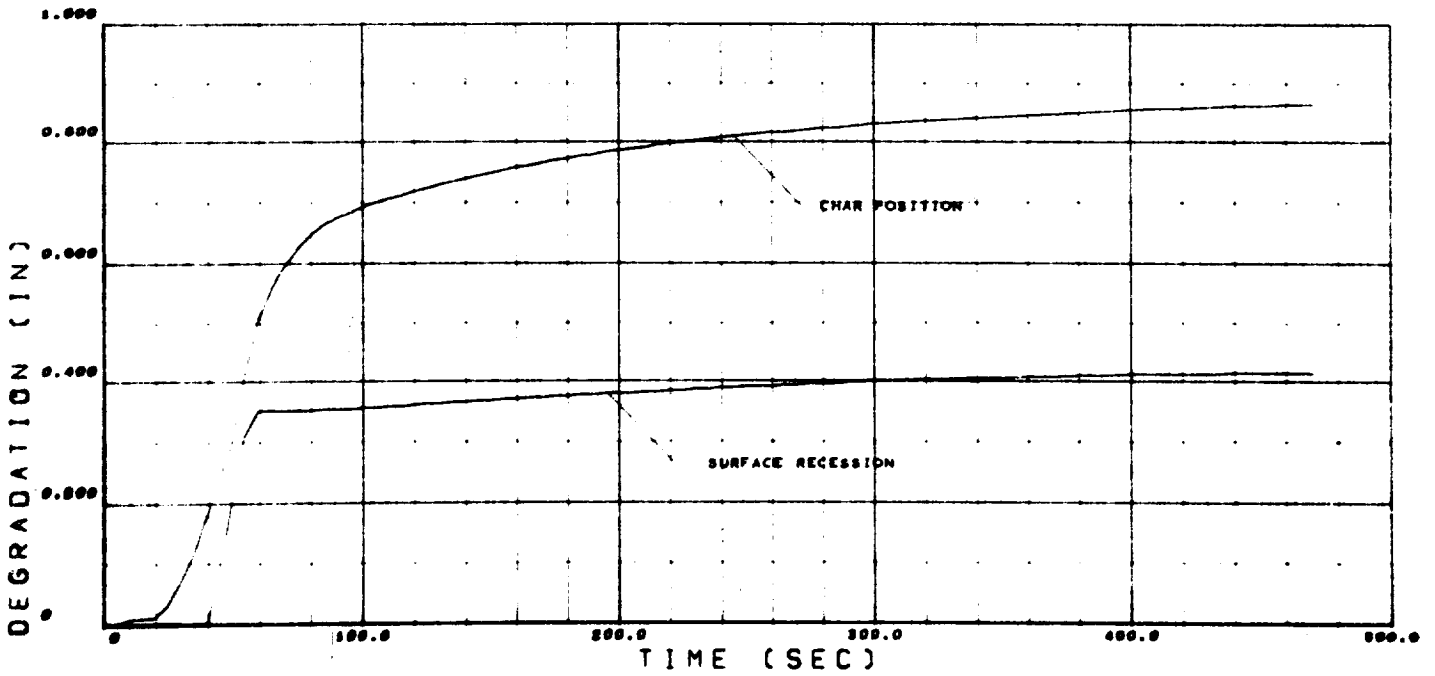
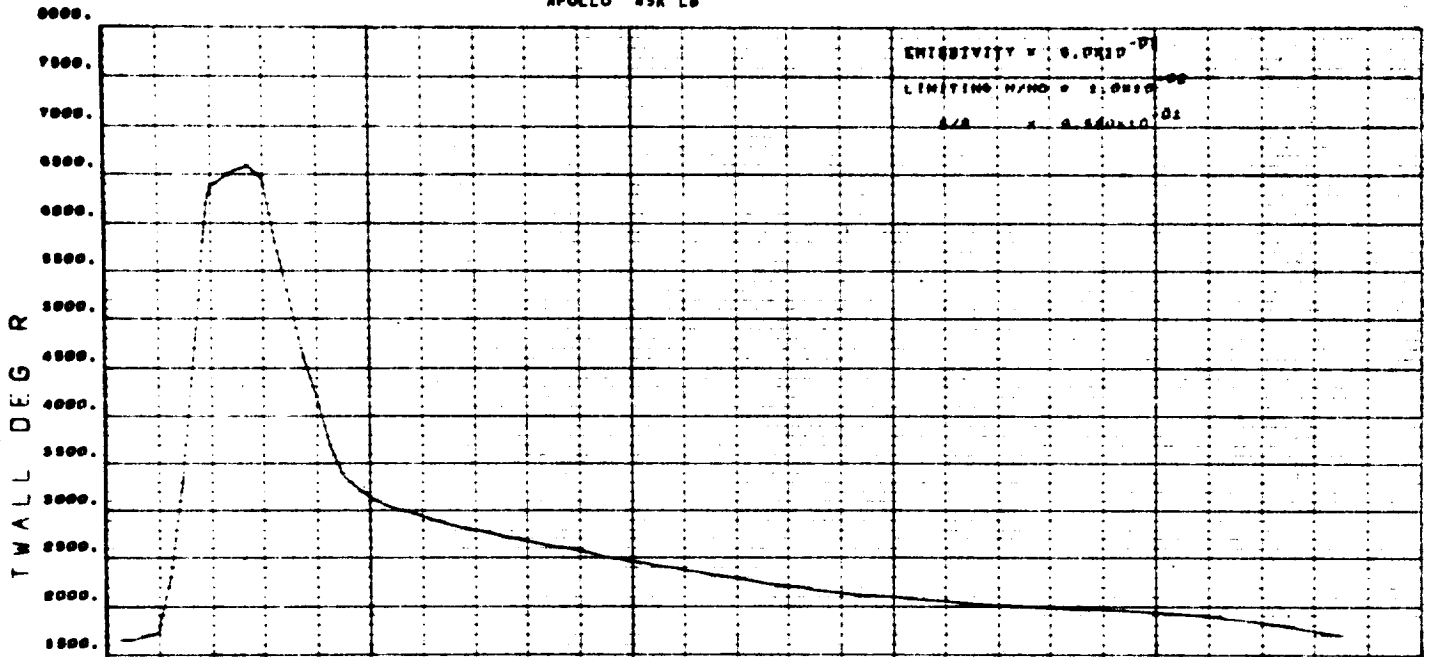


FIGURE A11

ENERGY ACCOMMODATION MECHANISMS

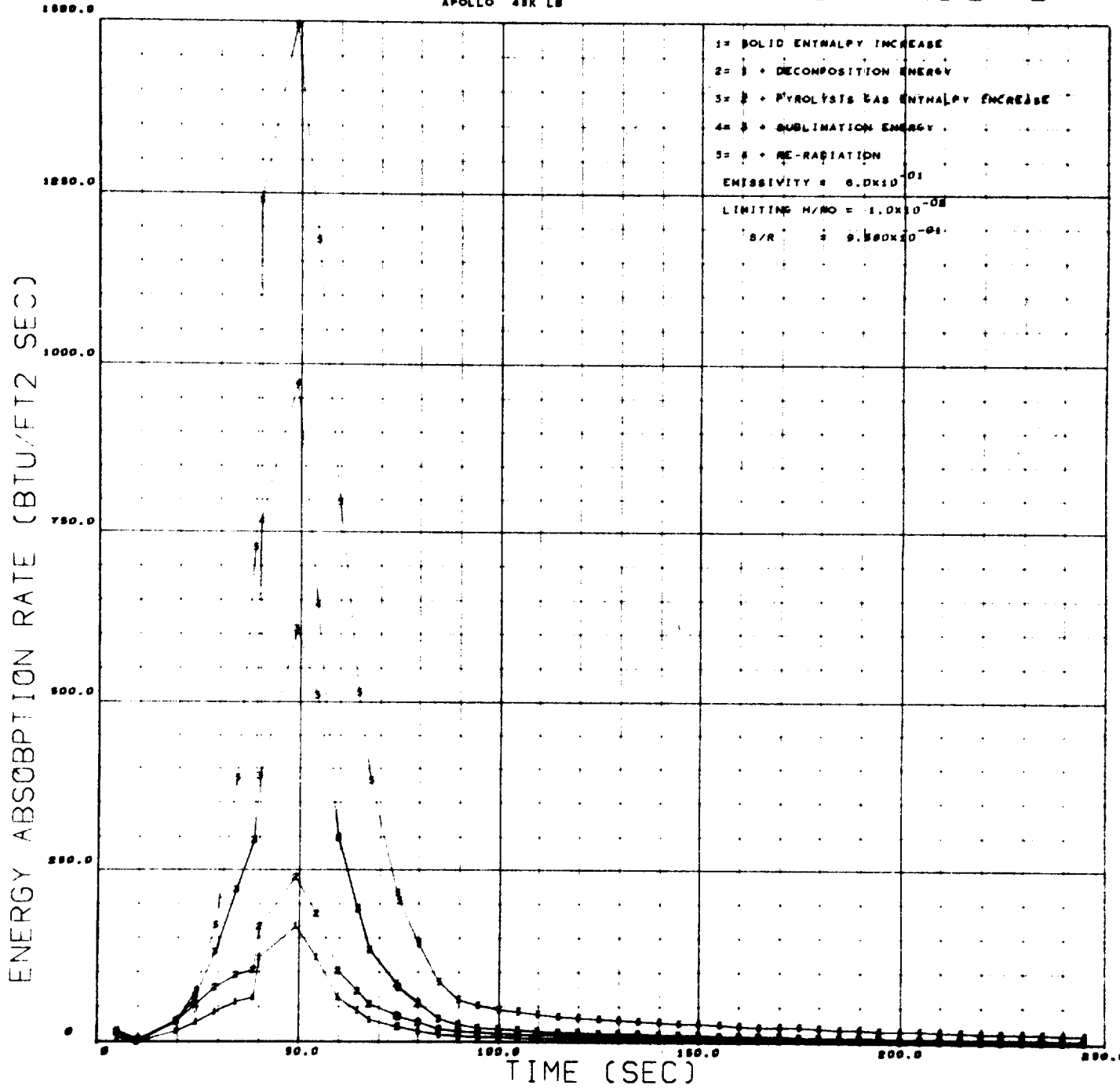


FIGURE A 12¹³

HEATING RATE HISTORY

APOLLO 75K LB

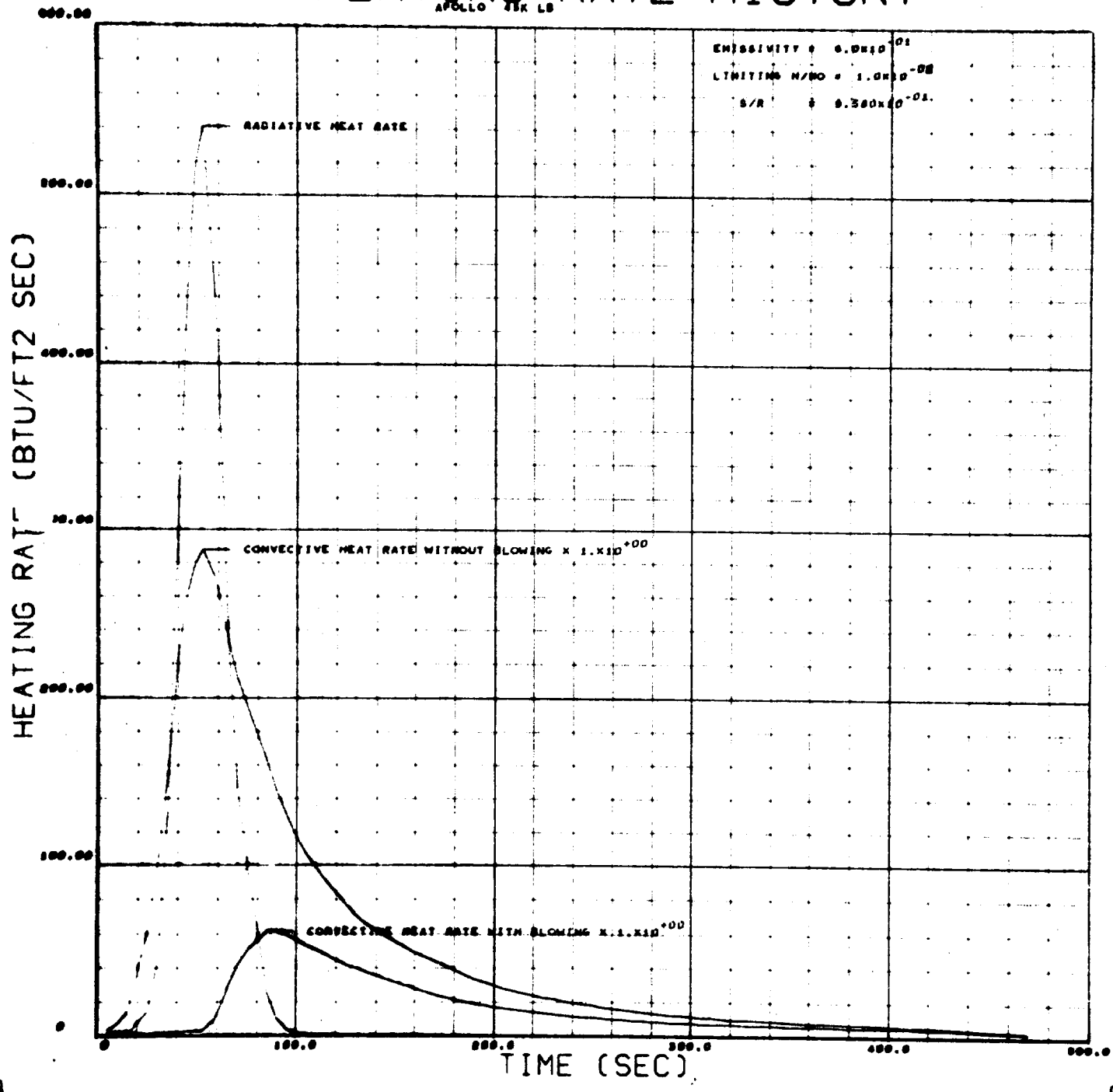


FIGURE A 12

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MATERIAL RESPONSE DATA

APOLLO 48K LB

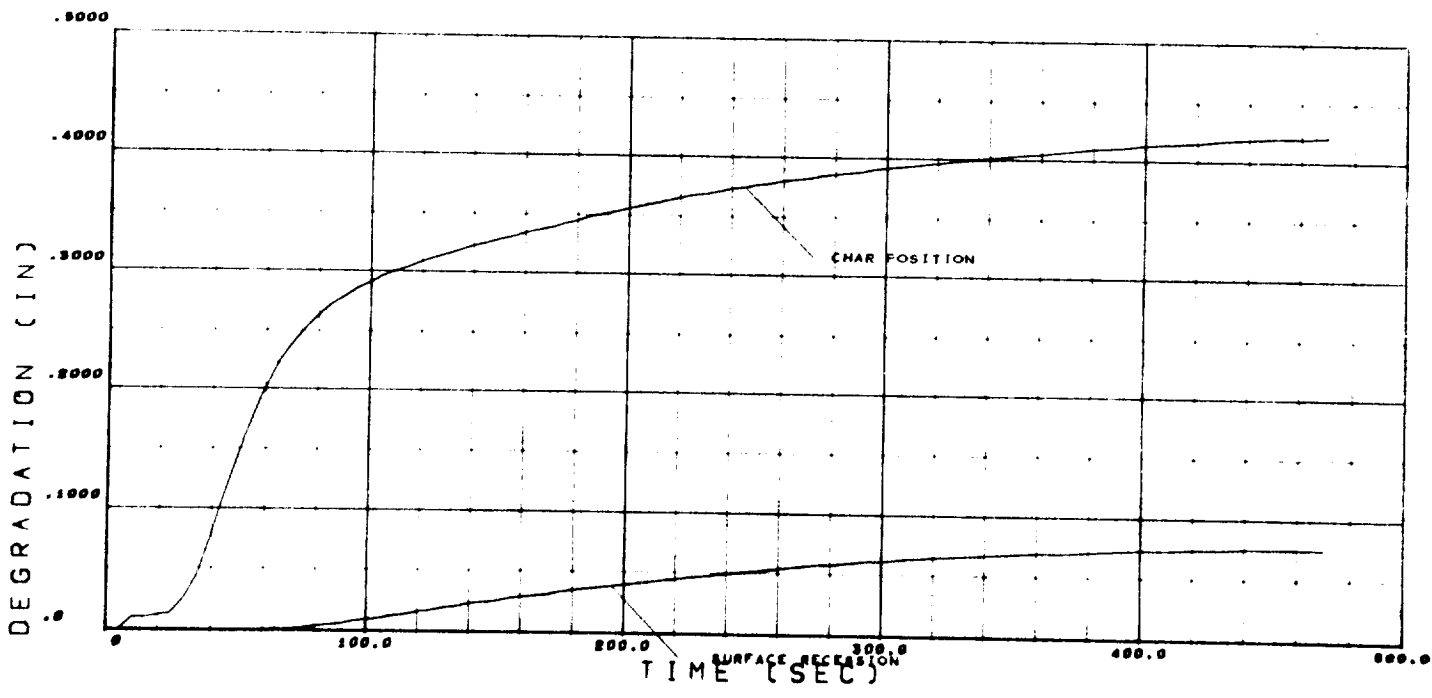
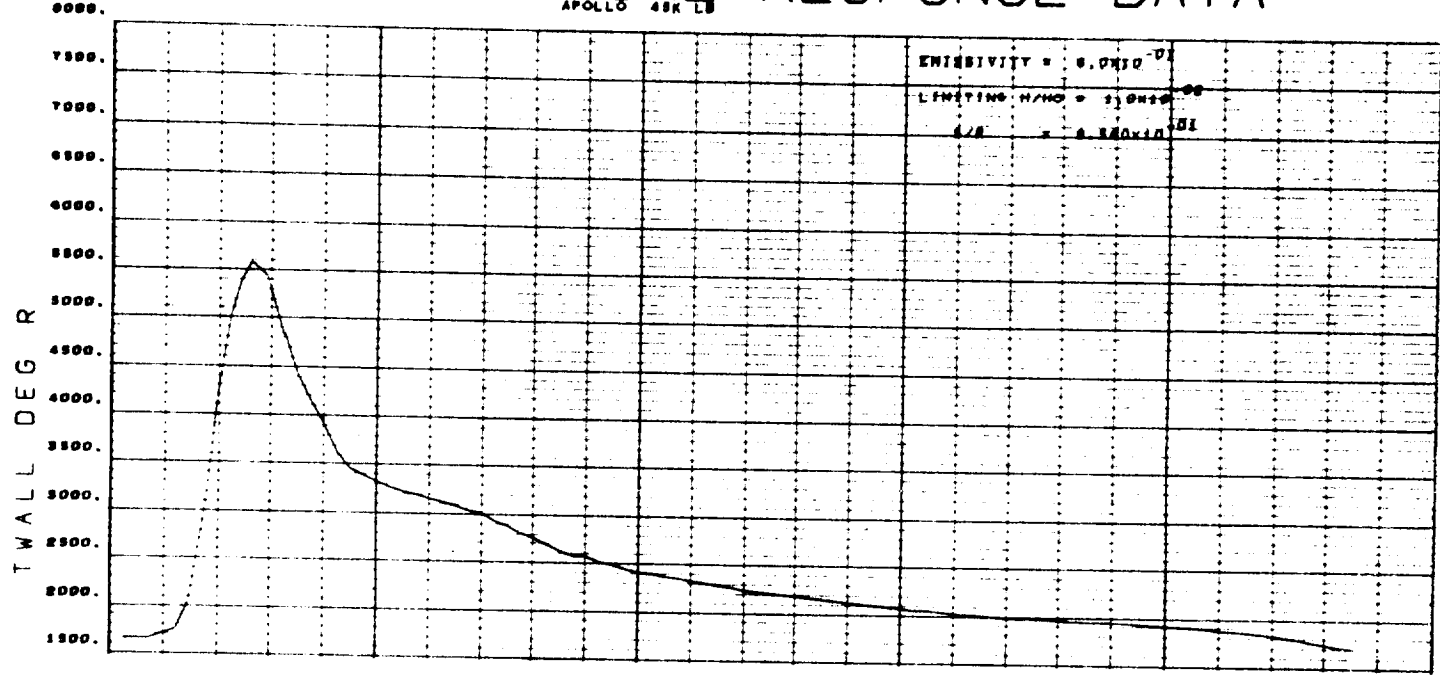
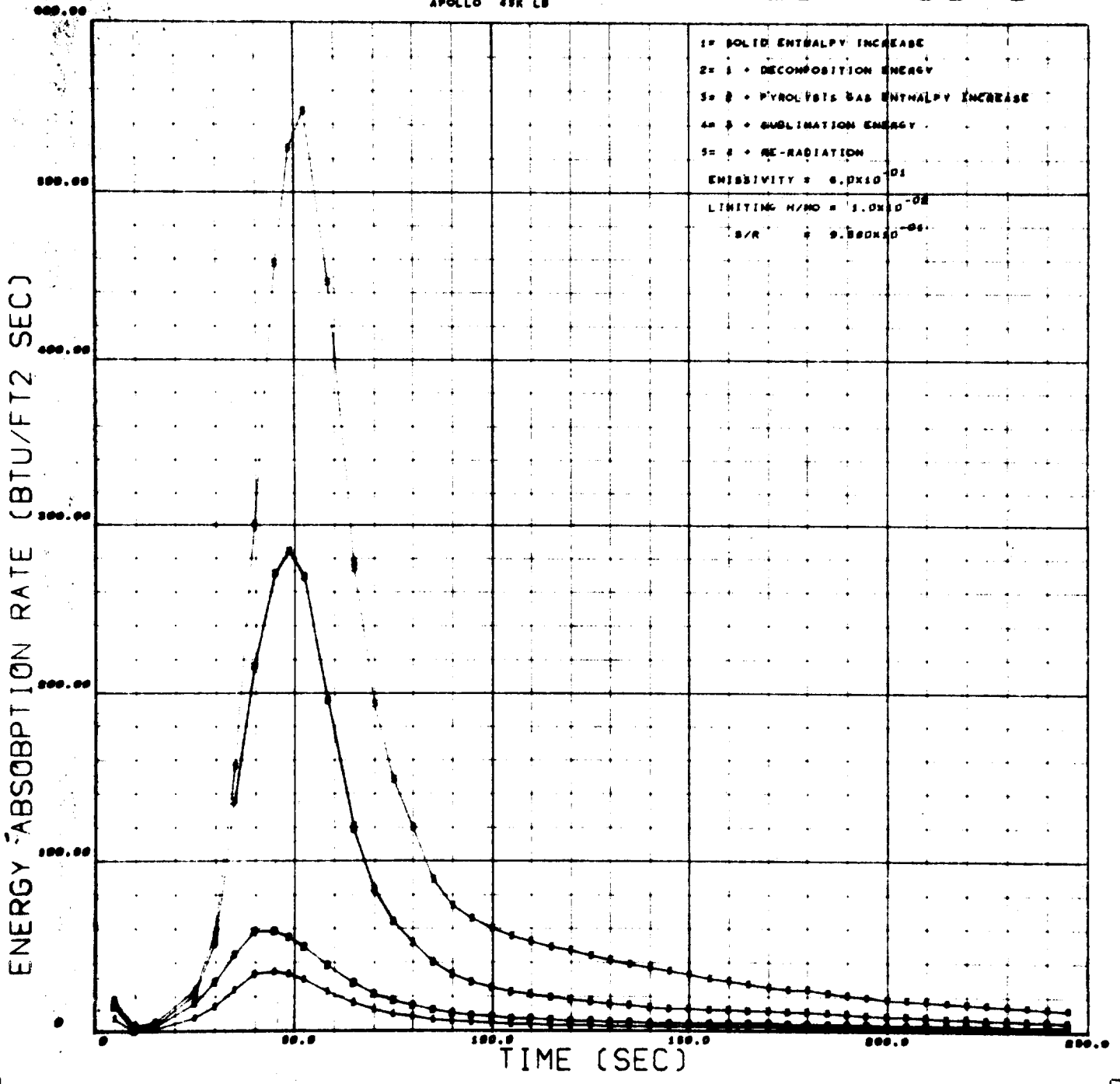


FIGURE A 12

13

ENERGY ACCOMMODATION MECHANISMS

APOLLO 75K LB



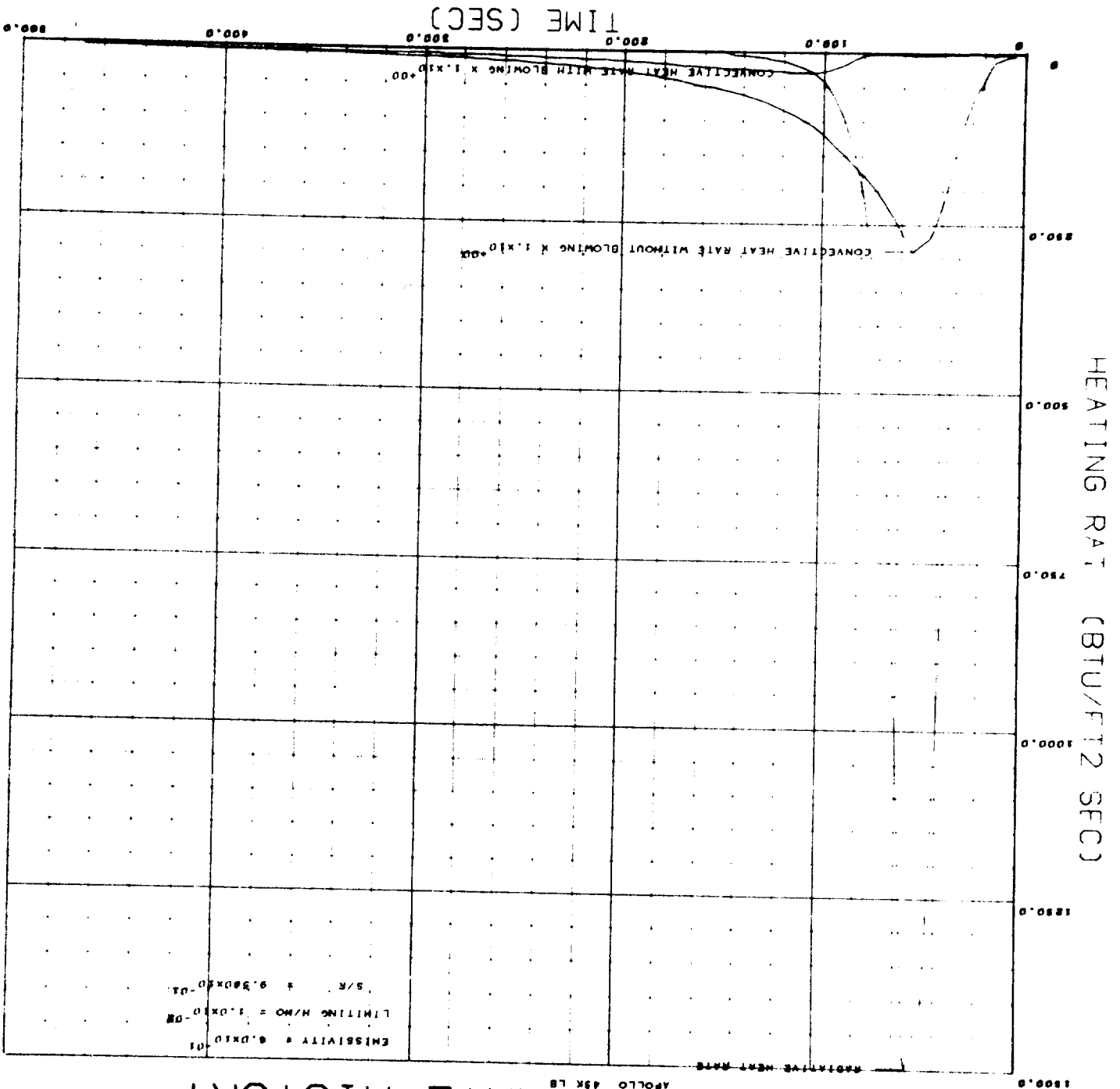


FIGURE # 13

13

FIGURE A13

MATERIAL RESPONSE DATA

APOLLO 43R LB

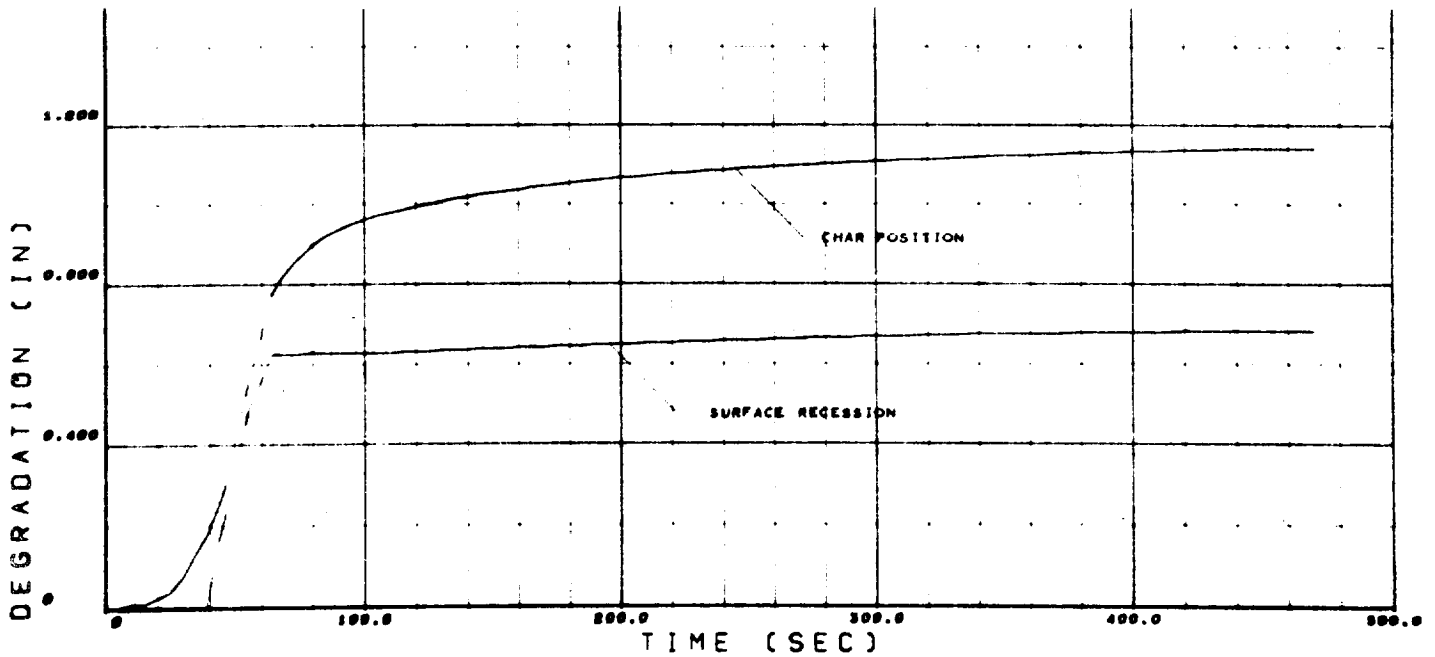
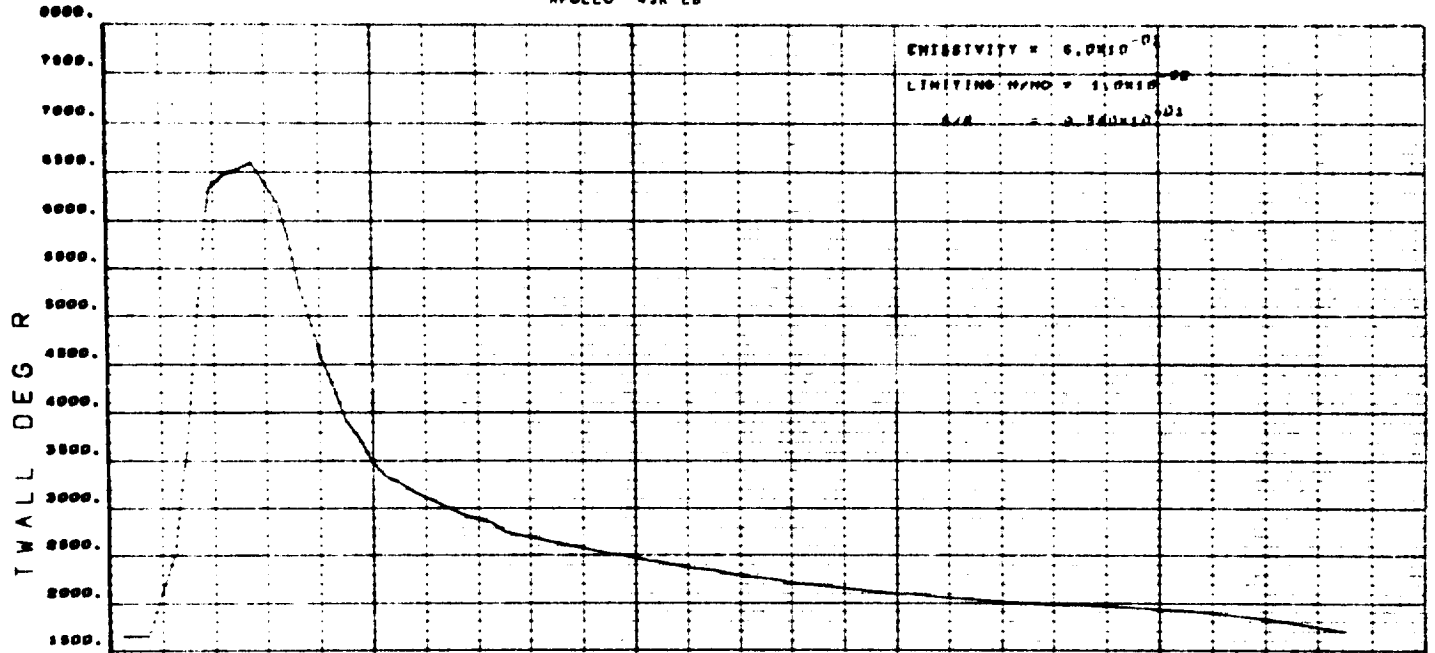


FIGURE A 13

ENERGY ACCOMMODATION MECHANISMS

APOLLO 45K LB

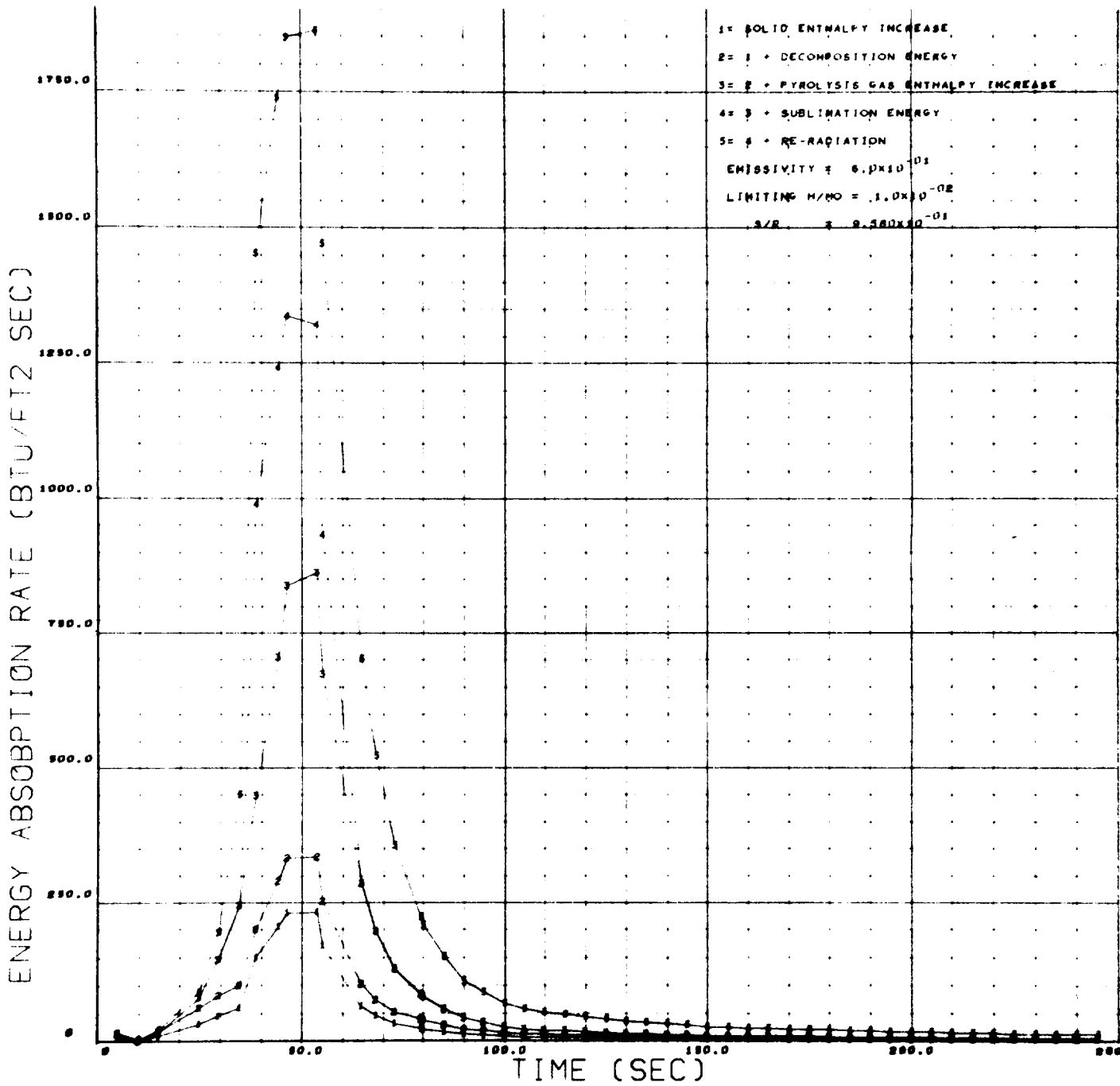


FIGURE A 14

HEATING RATE HISTORY

APOLLO FOR LB

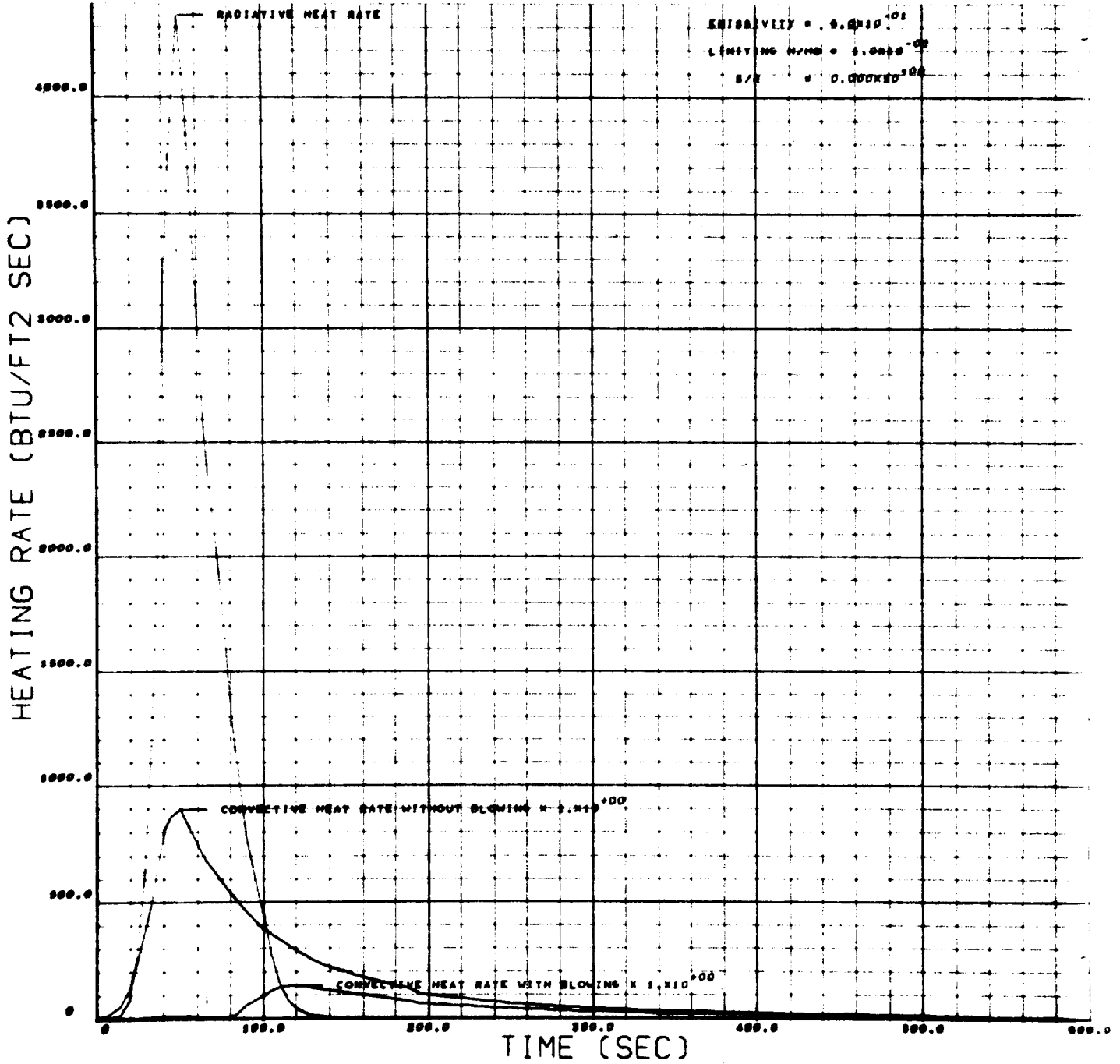


FIGURE A 14

MATERIAL RESPONSE DATA

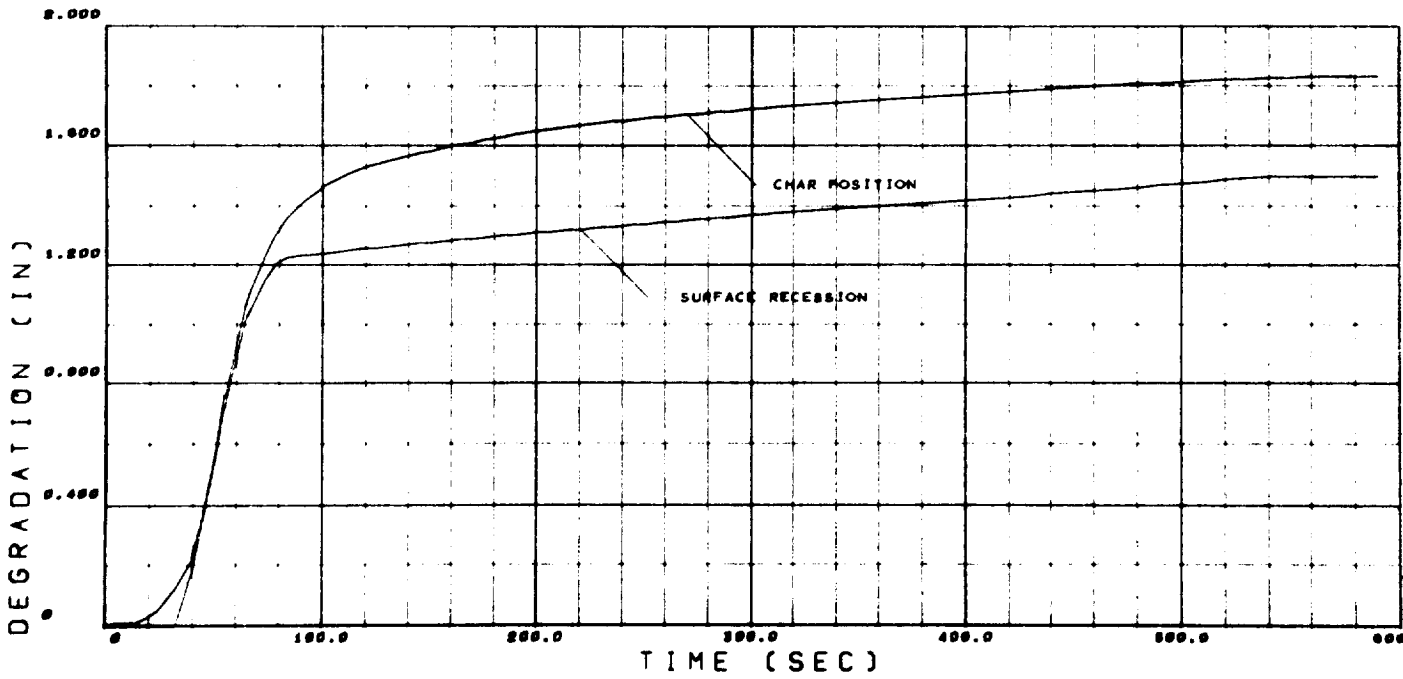
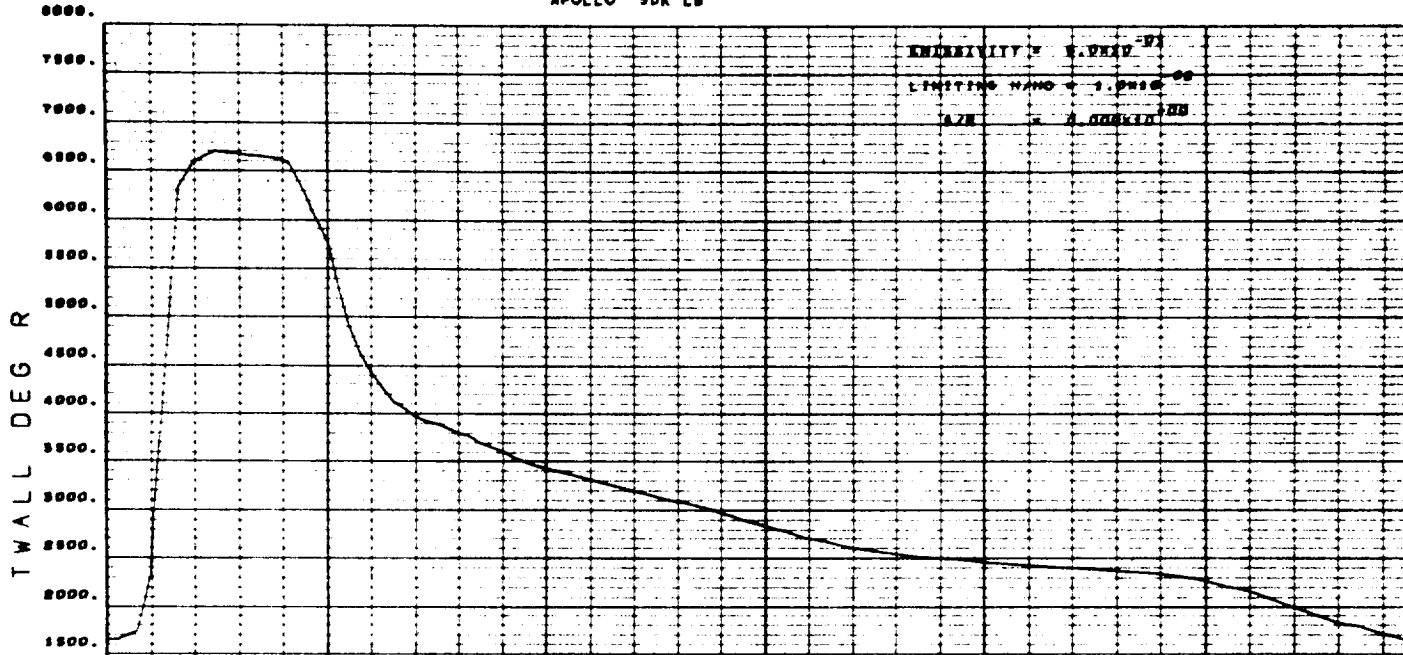


FIGURE A14

ENERGY ACCOMMODATION MECHANISMS

APOLLO 10X LB

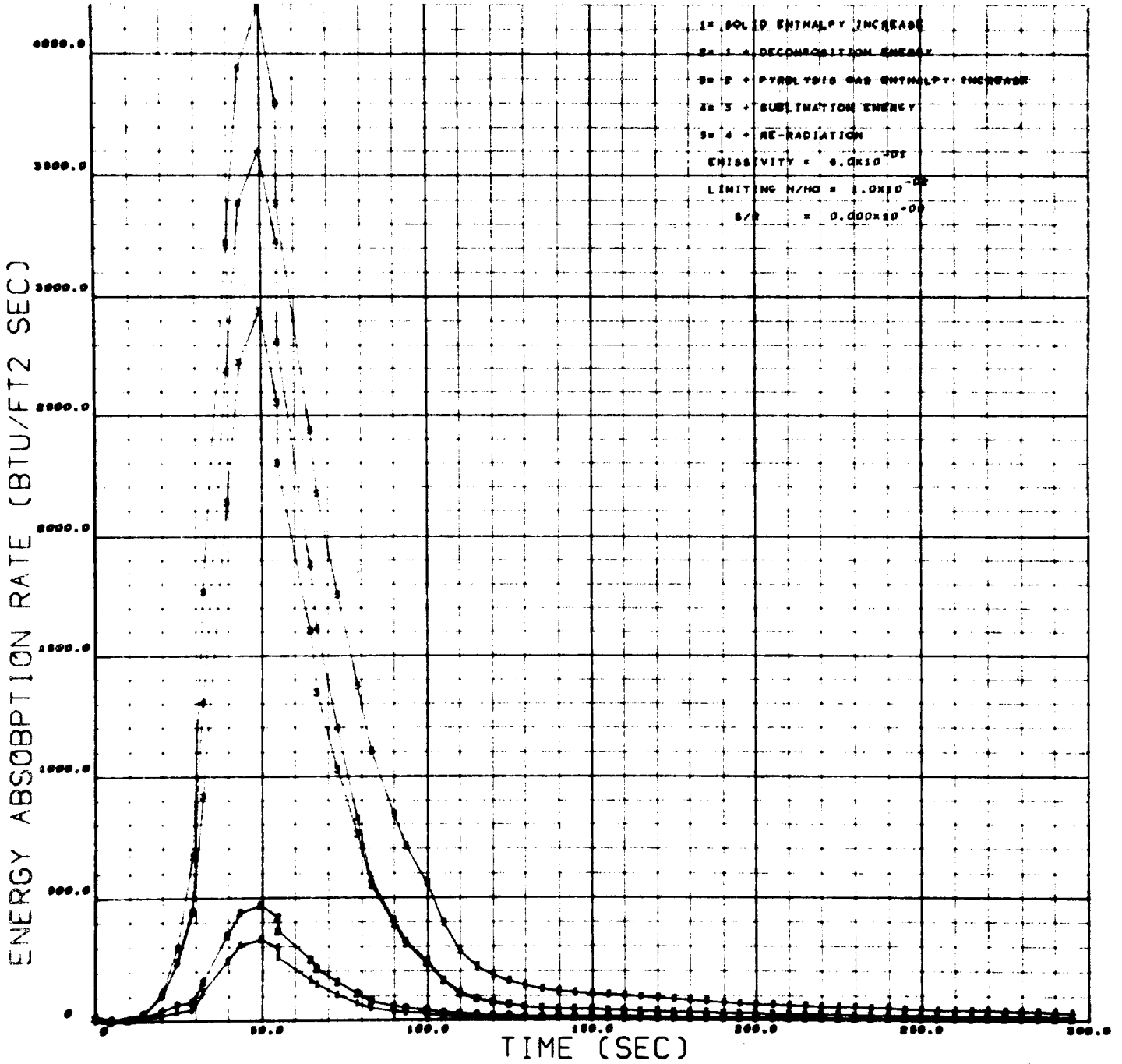


FIGURE A15

MATERIAL RESPONSE DATA

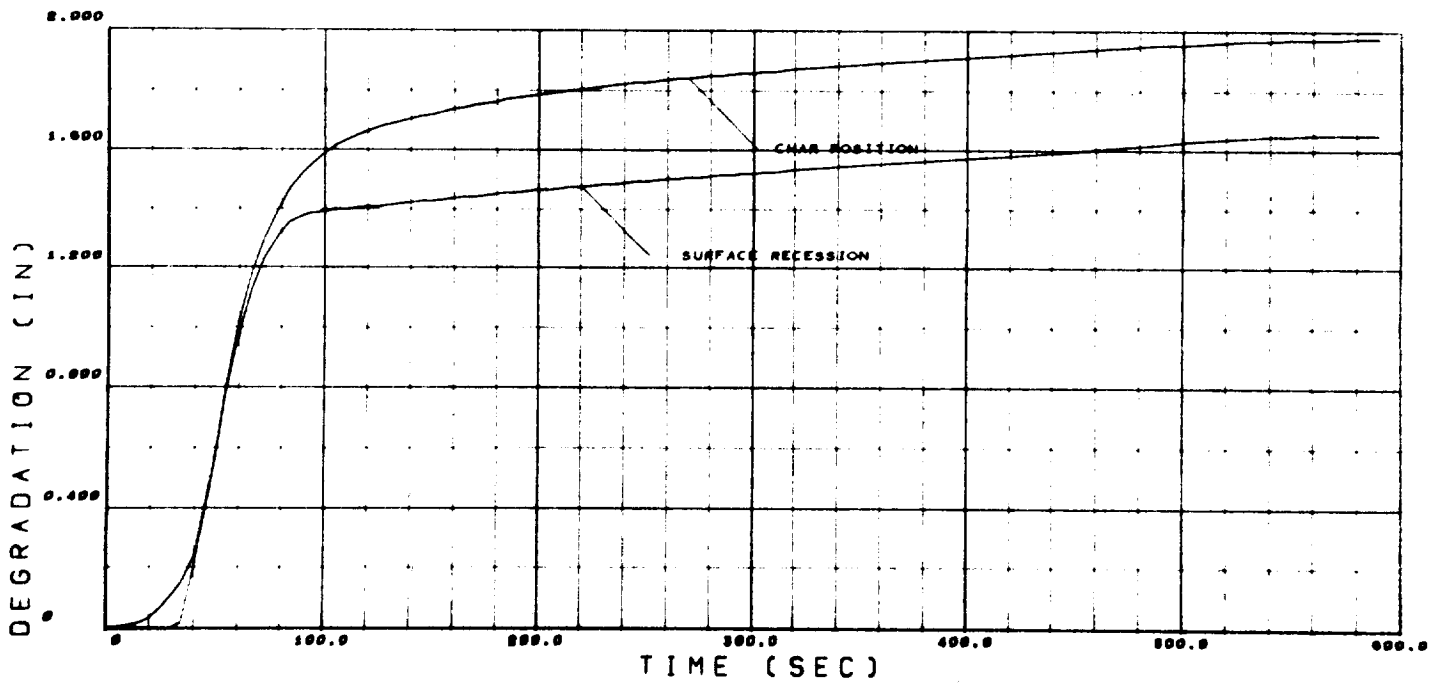
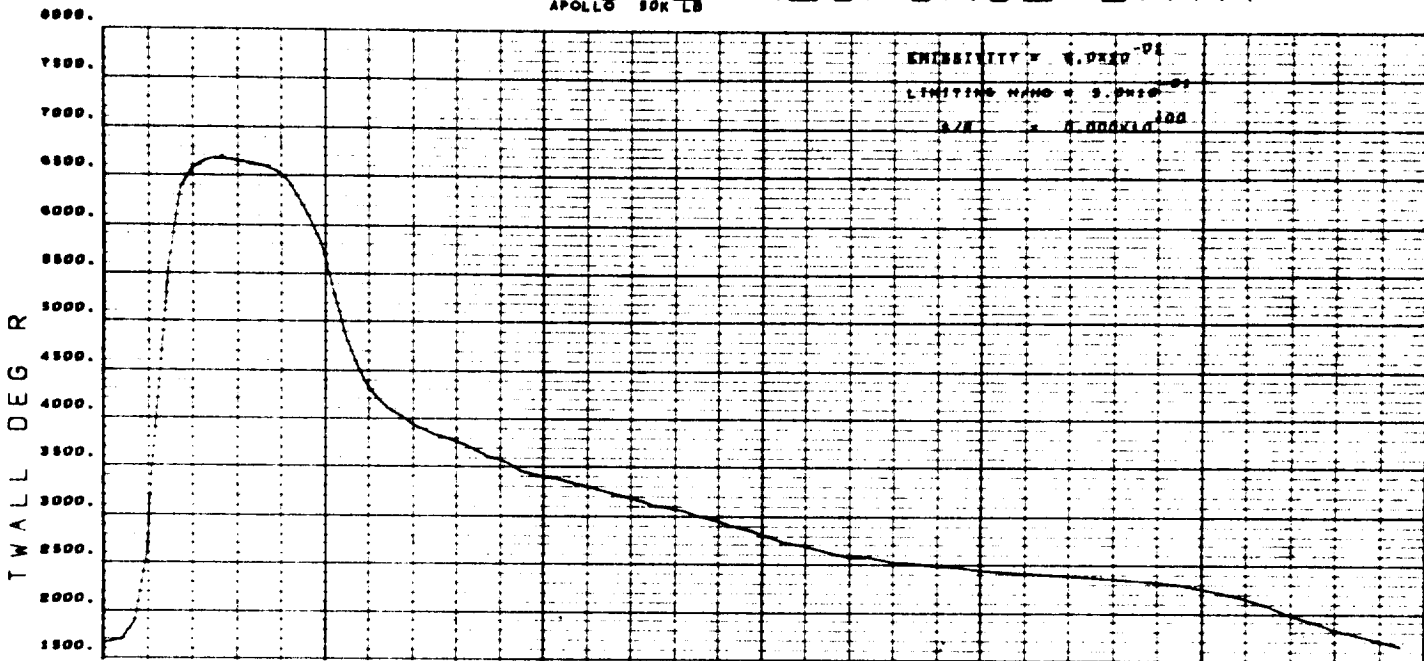


FIGURE A 15

ENERGY ACCOMMODATION MECHANISMS

APOLLO 10K LB

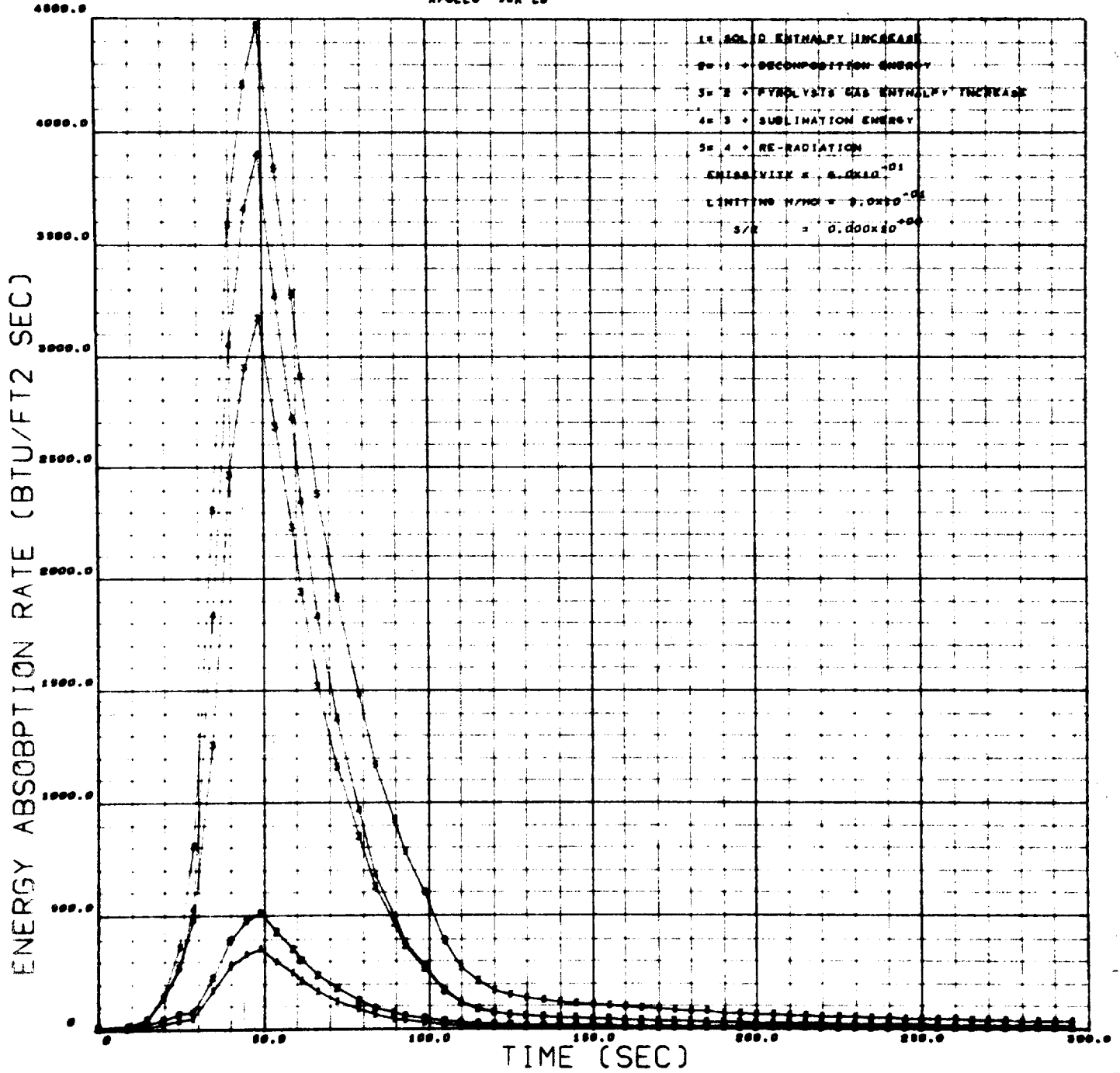


FIGURE A 15

HEATING RATE HISTORY

APOLLO 30K LB

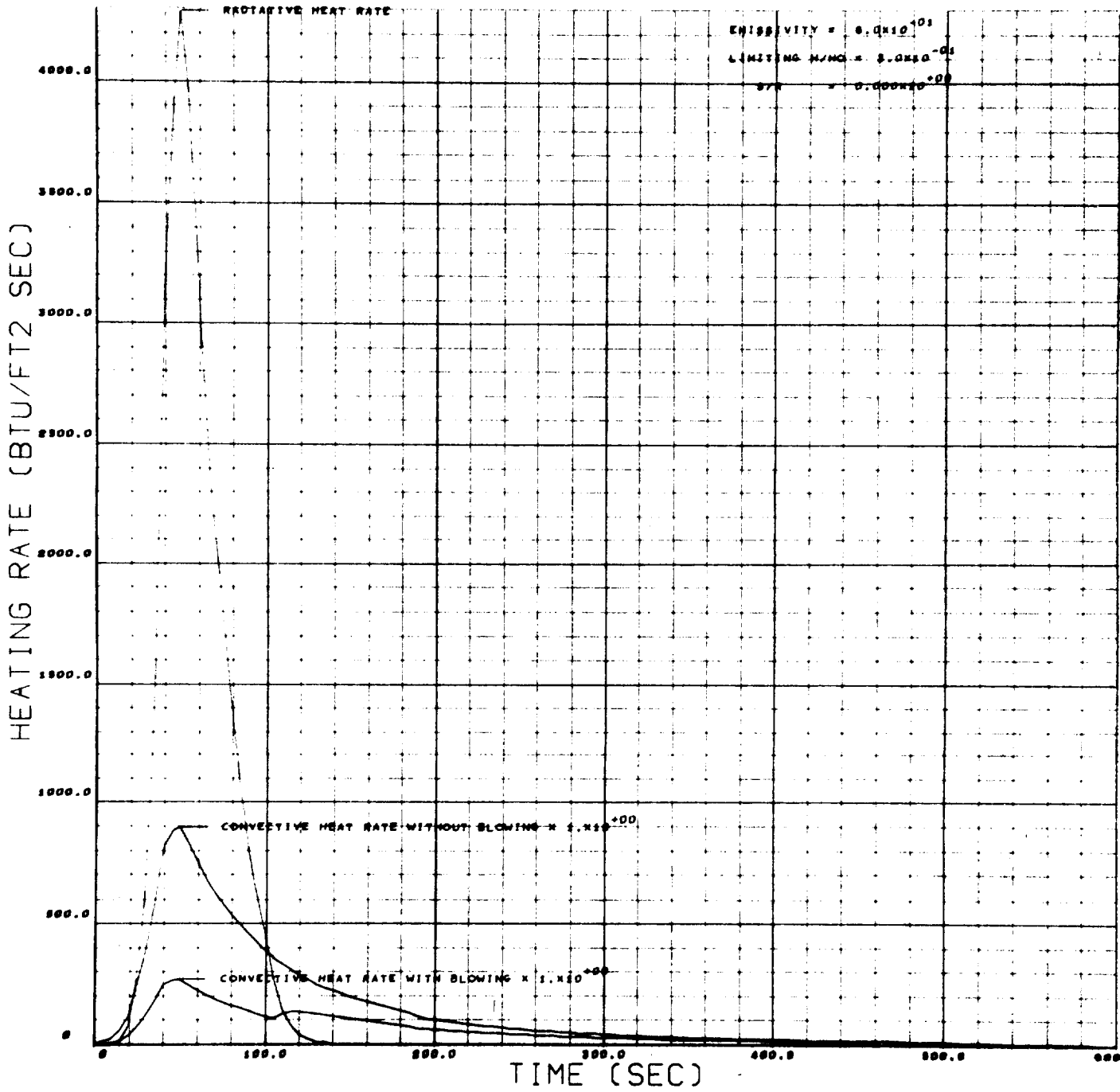


FIGURE A 16

HEATING RATE HISTORY

APOLLO 30X LB

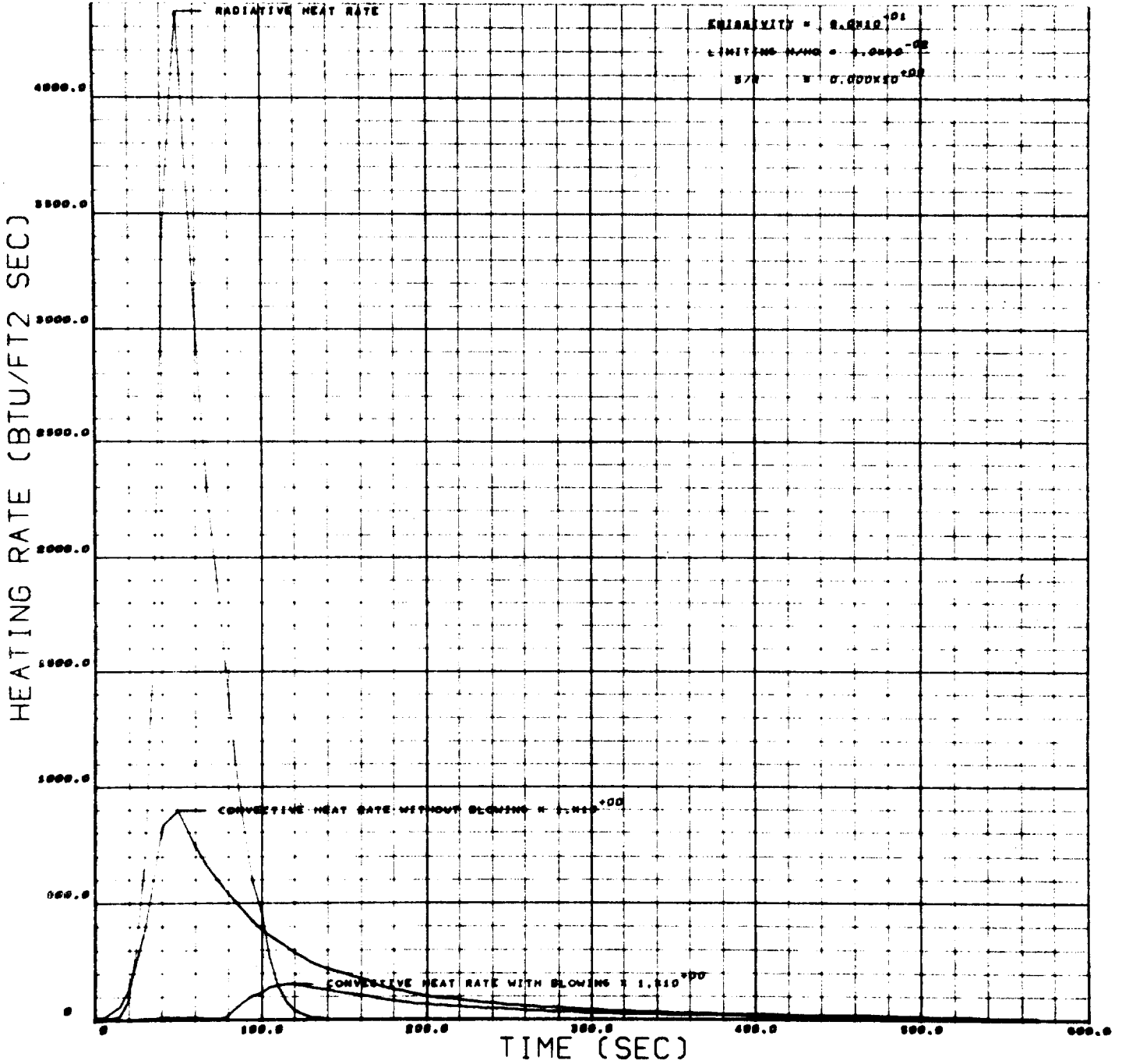


FIGURE A16

MATERIAL RESPONSE DATA

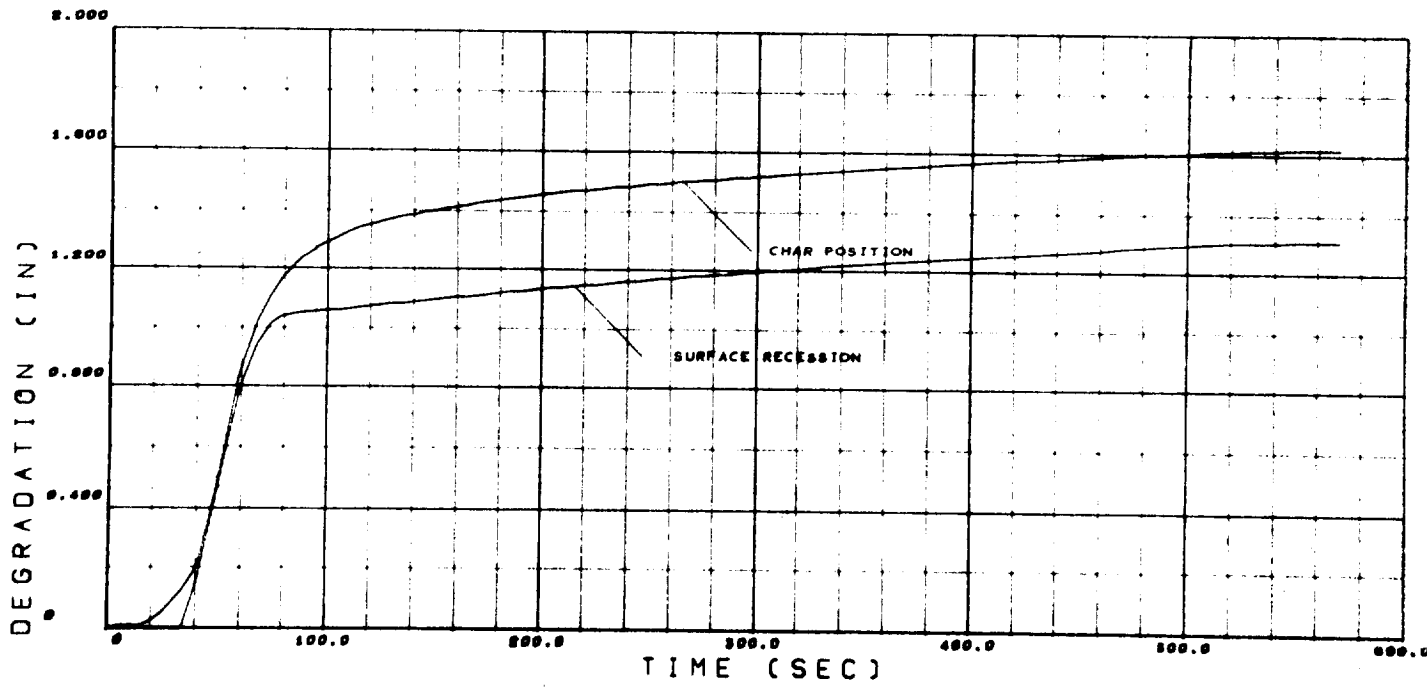
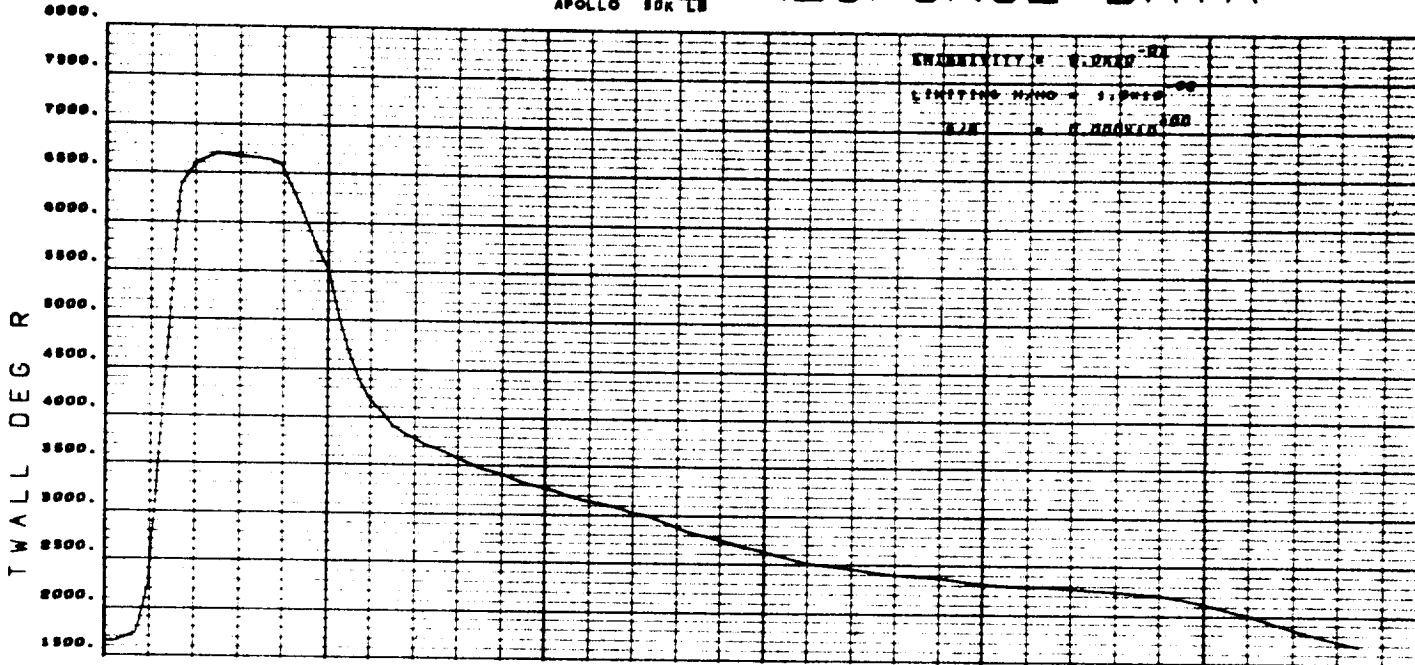


FIGURE A 16

ENERGY ACCOMMODATION MECHANISMS

APOLLO 10X LB

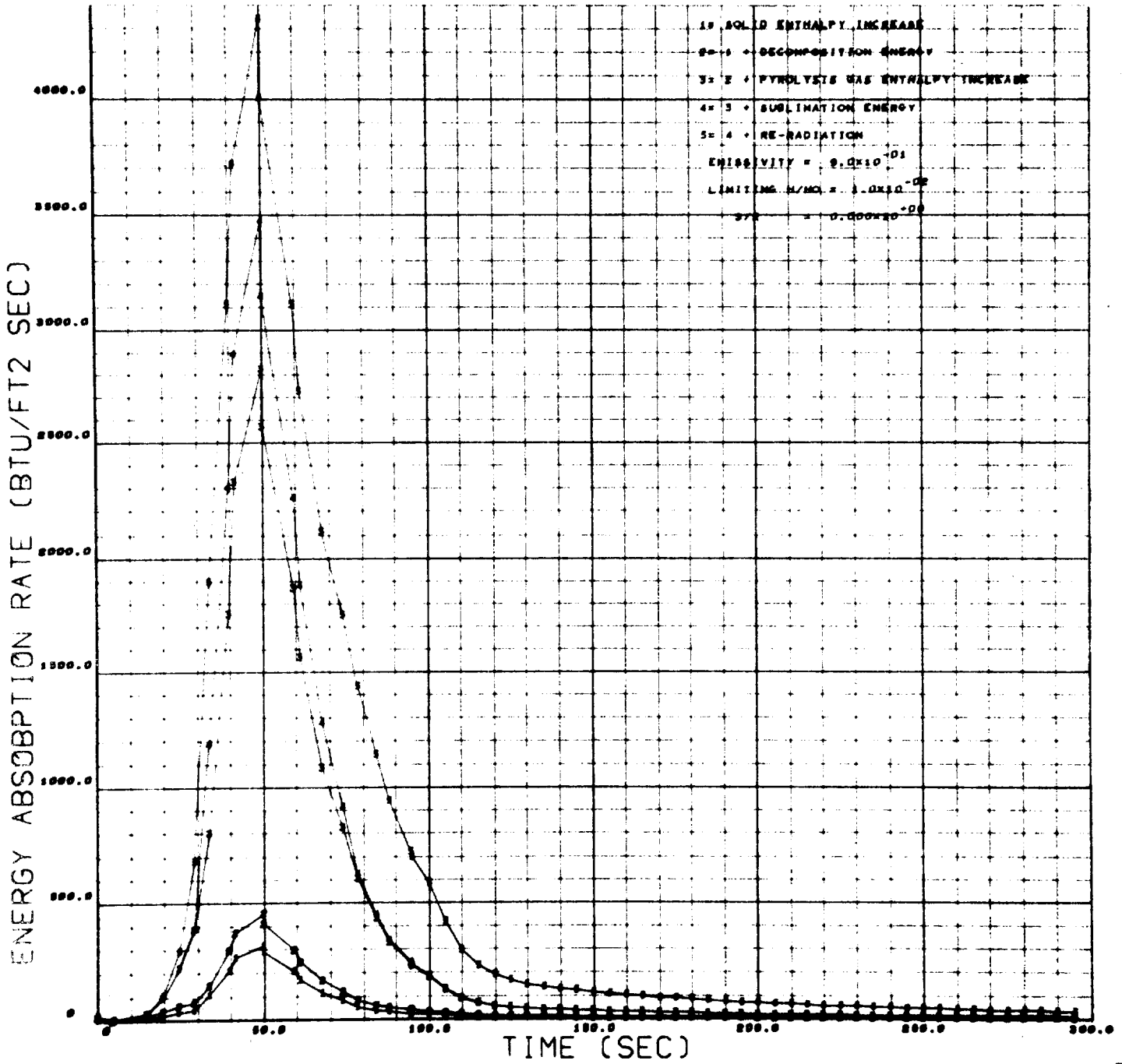


FIGURE A17

HEATING RATE HISTORY

APOLLO 30K LB

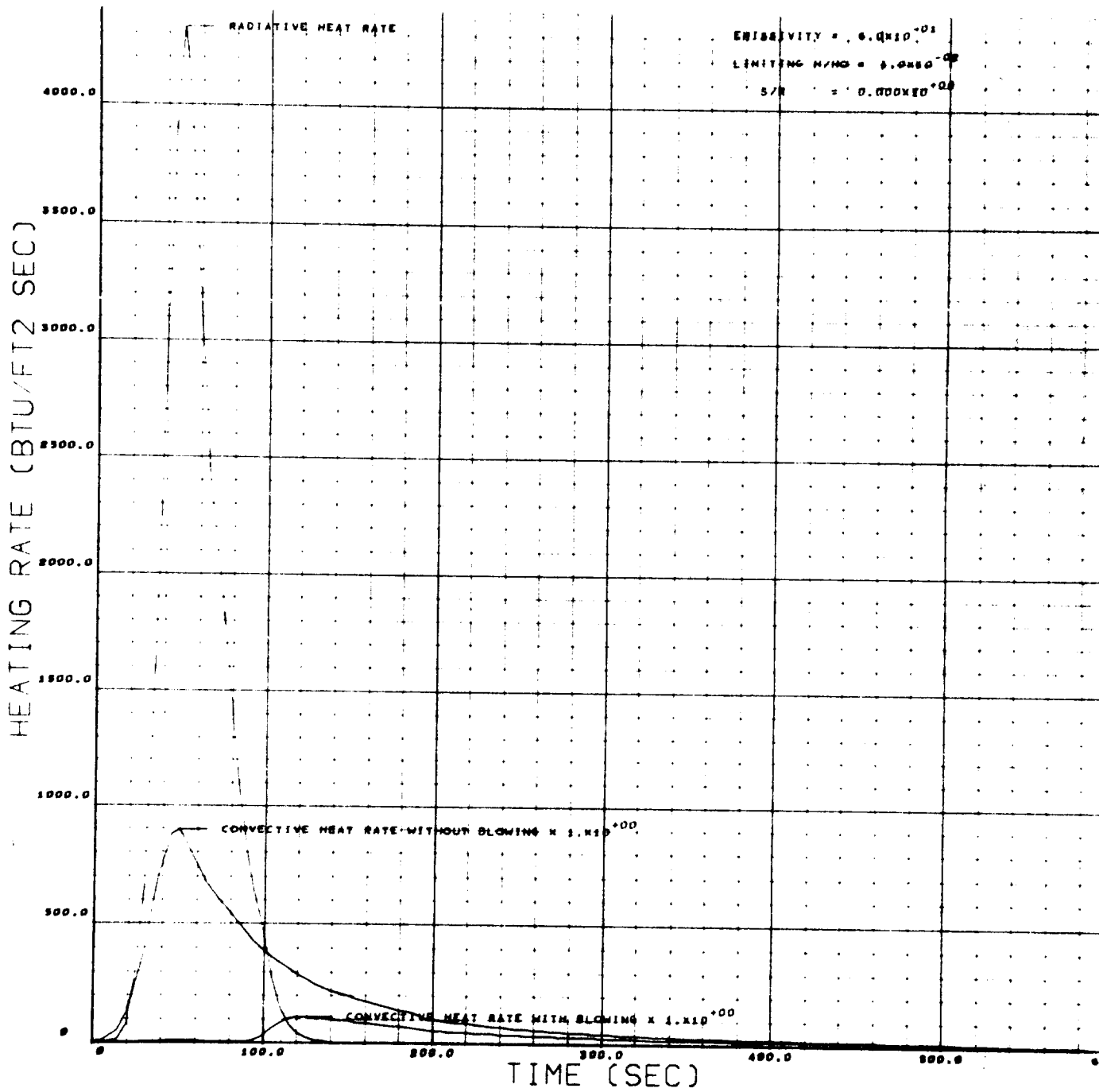


FIGURE A17

MATERIAL RESPONSE DATA

APOLLO 50K LB

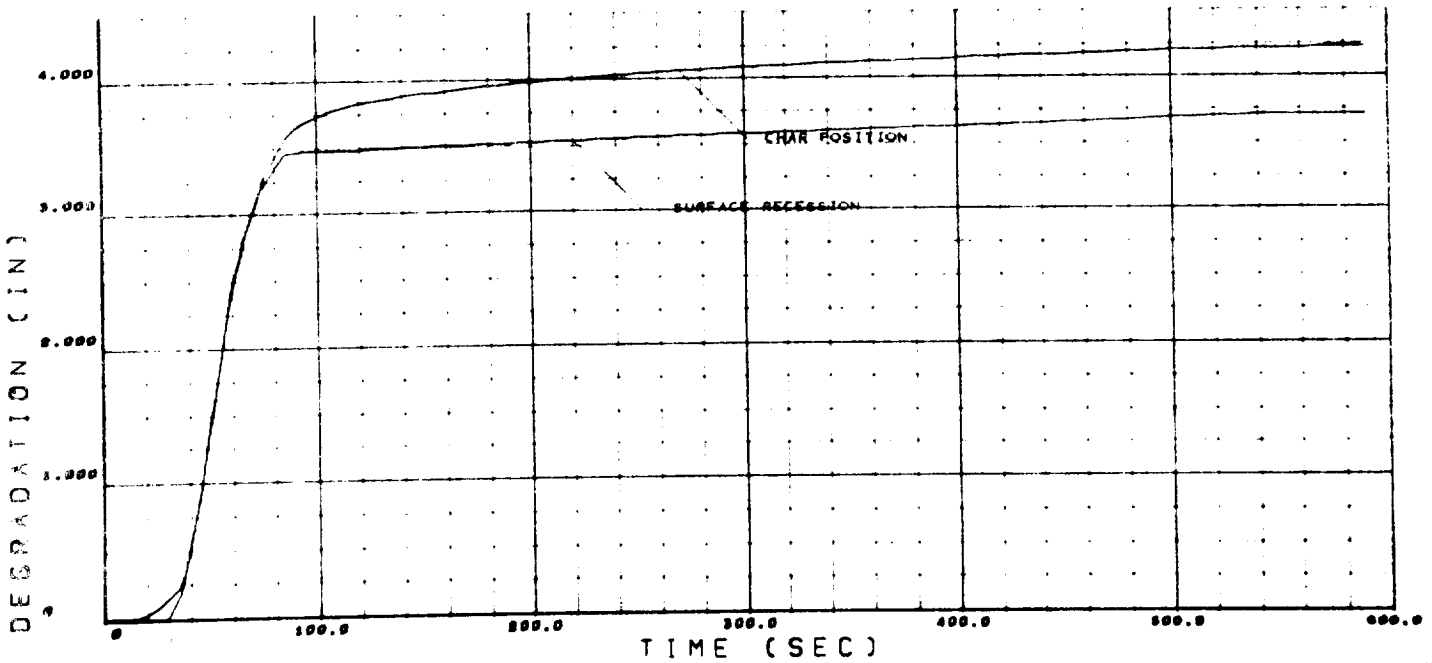
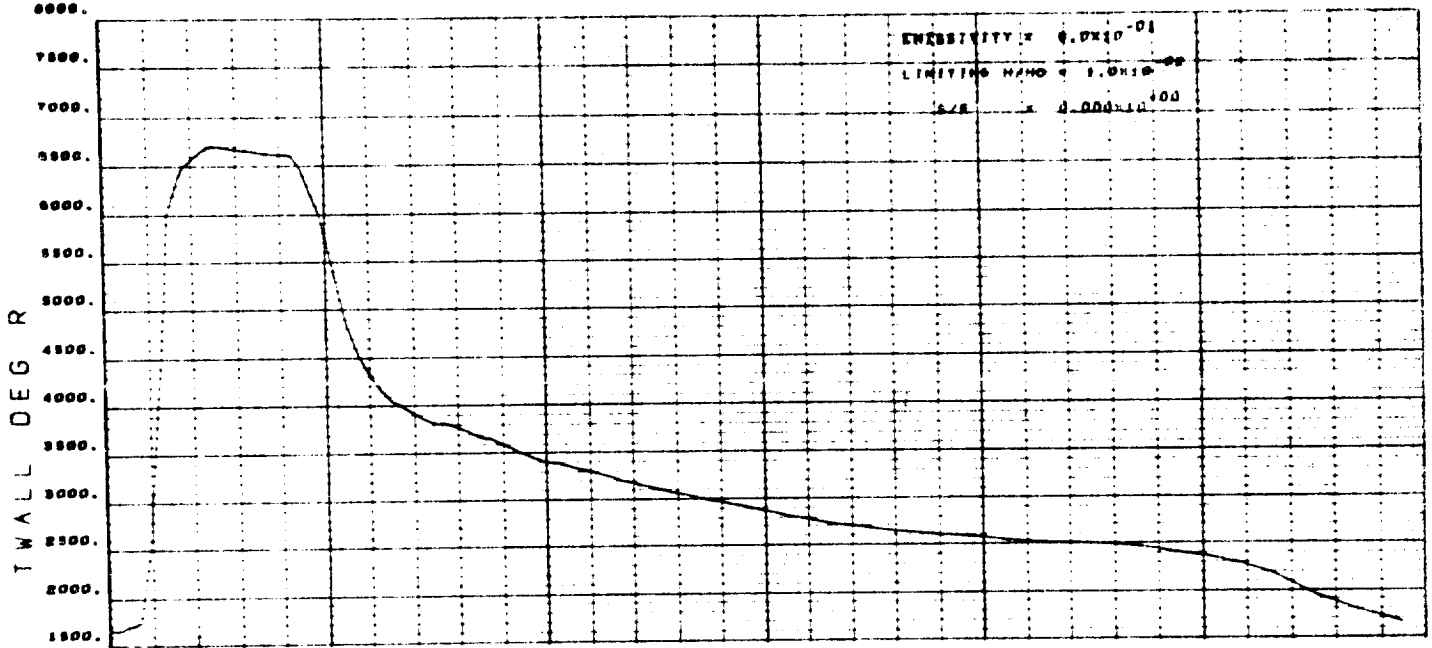


FIGURE A 17

ENERGY ACCOMMODATION MECHANISMS

APOLLO 50K LB

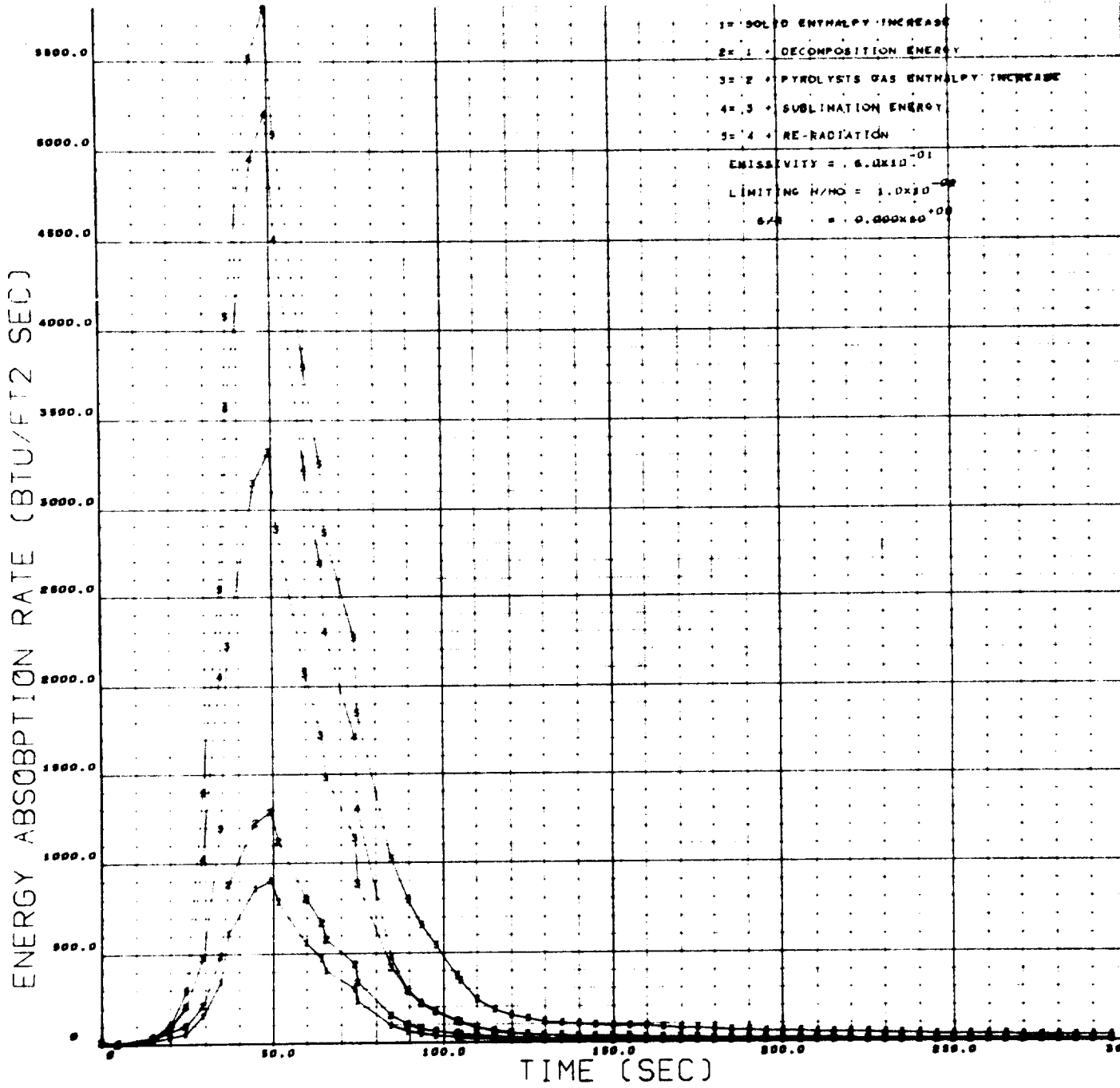


FIGURE A18

HEATING RATE HISTORY

APOLLO 30K LB

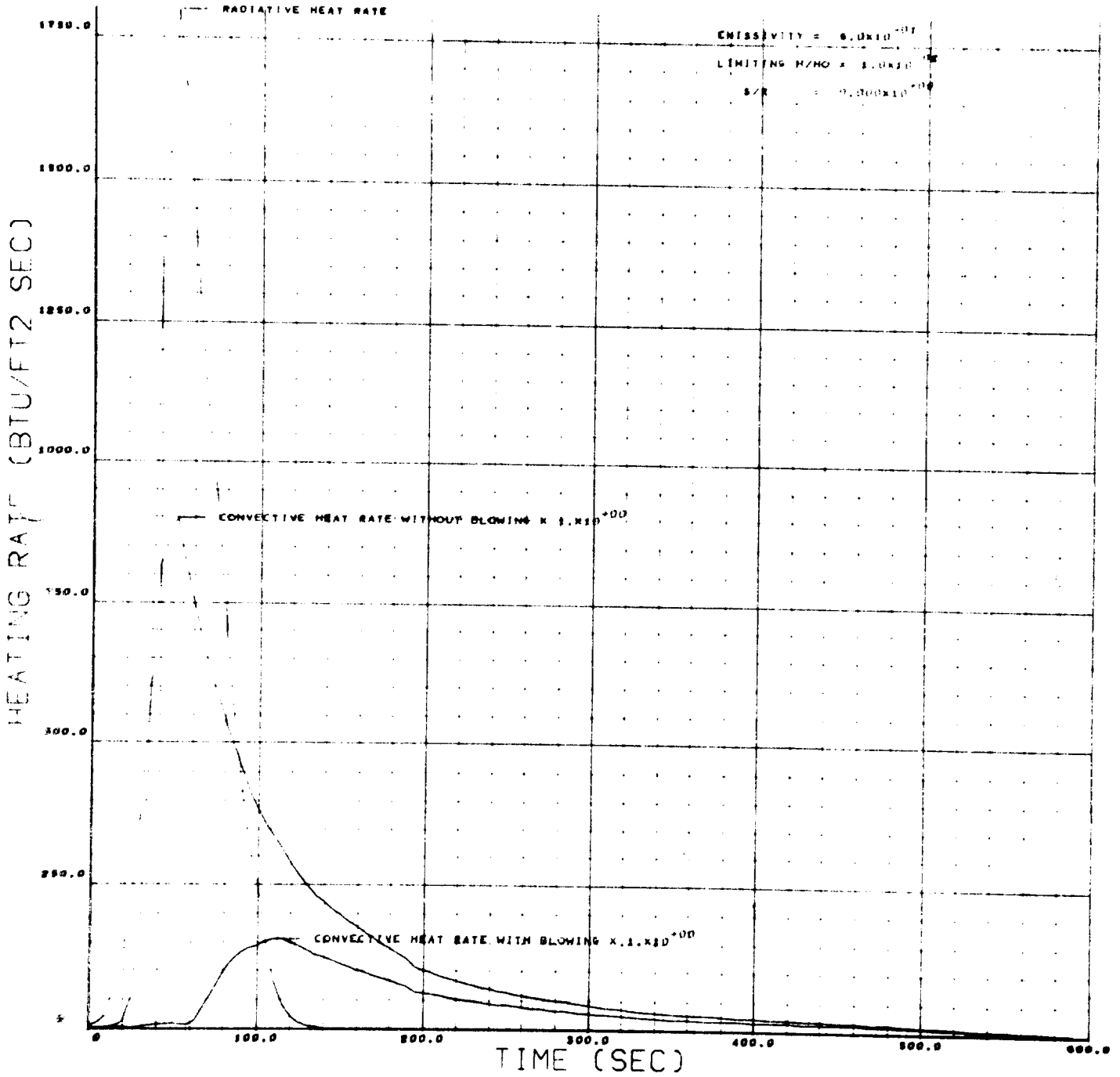


FIGURE A18

MATERIAL RESPONSE DATA

APOLLO 50K LB

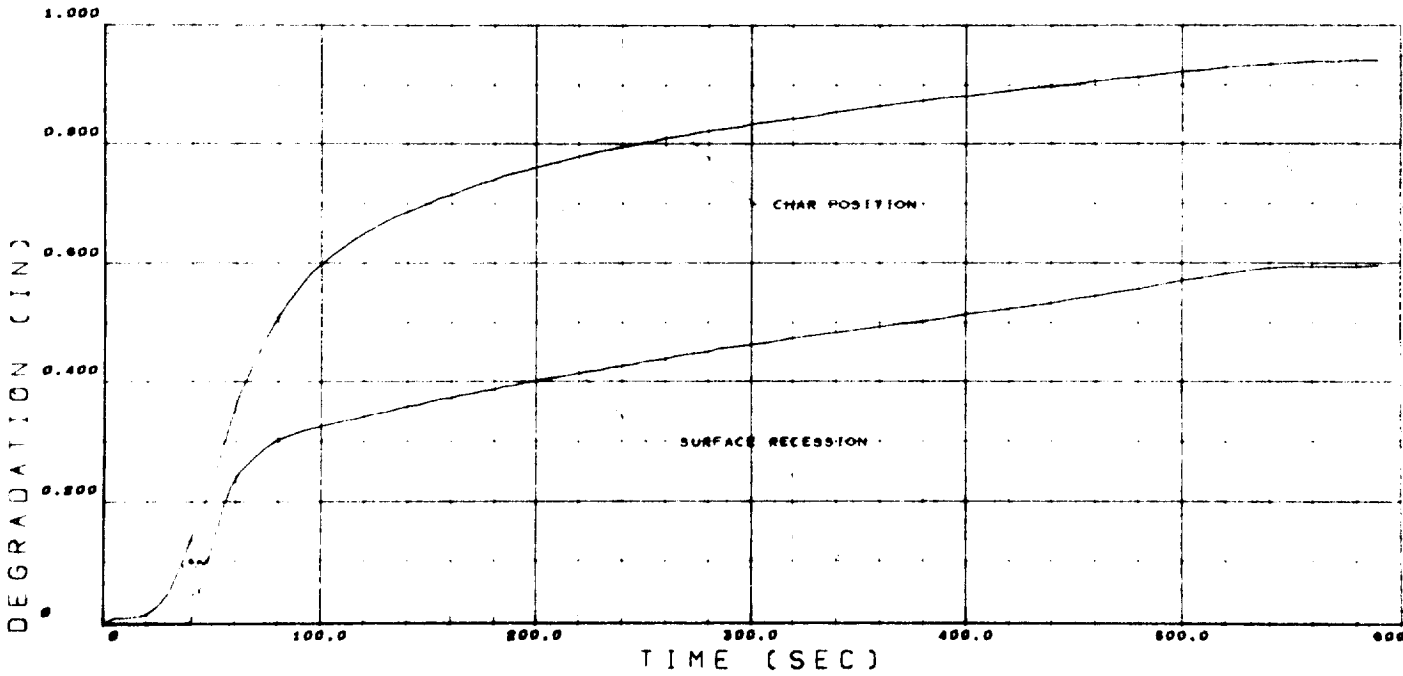
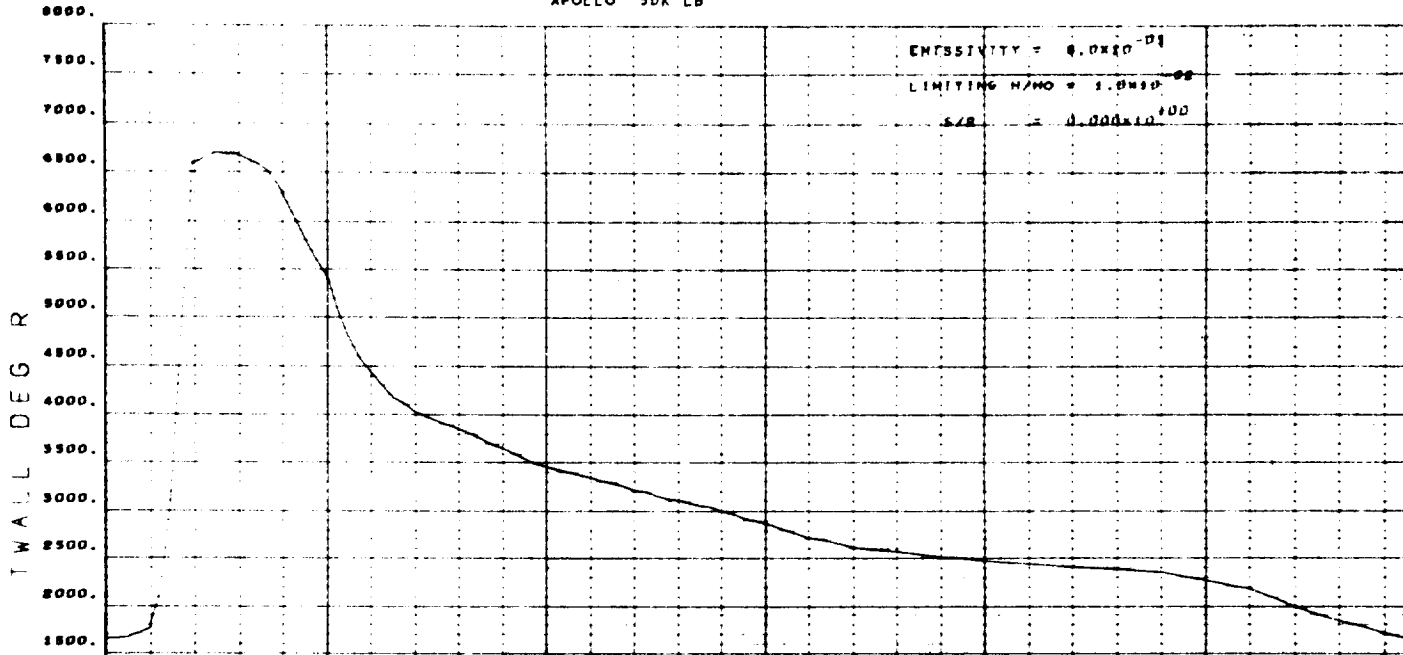


FIGURE A 18

ENERGY ACCOMMODATION MECHANISMS

APOLLO 30K LB

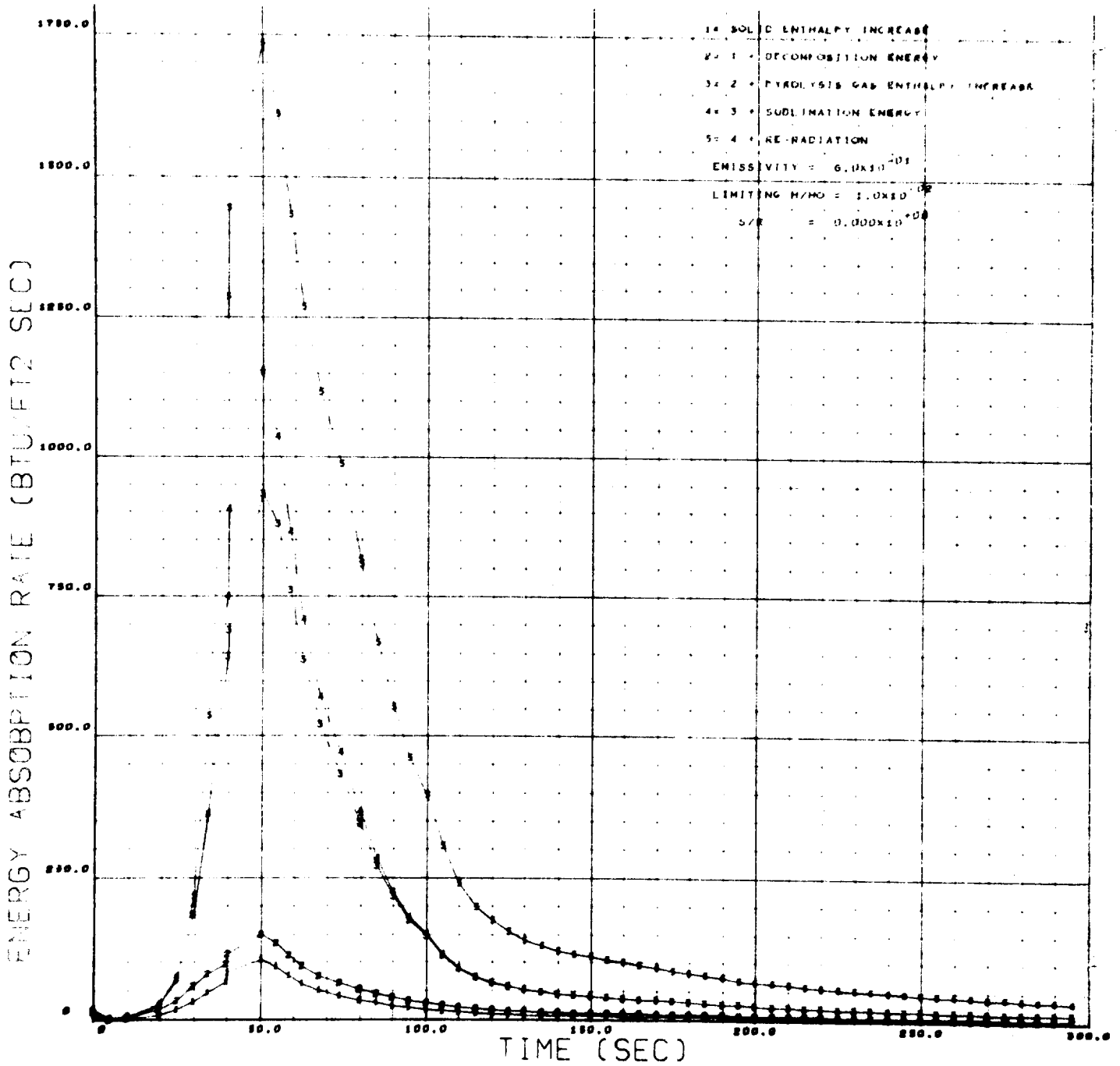


FIGURE A19

HEATING RATE HISTORY

APOLLO 30K LB

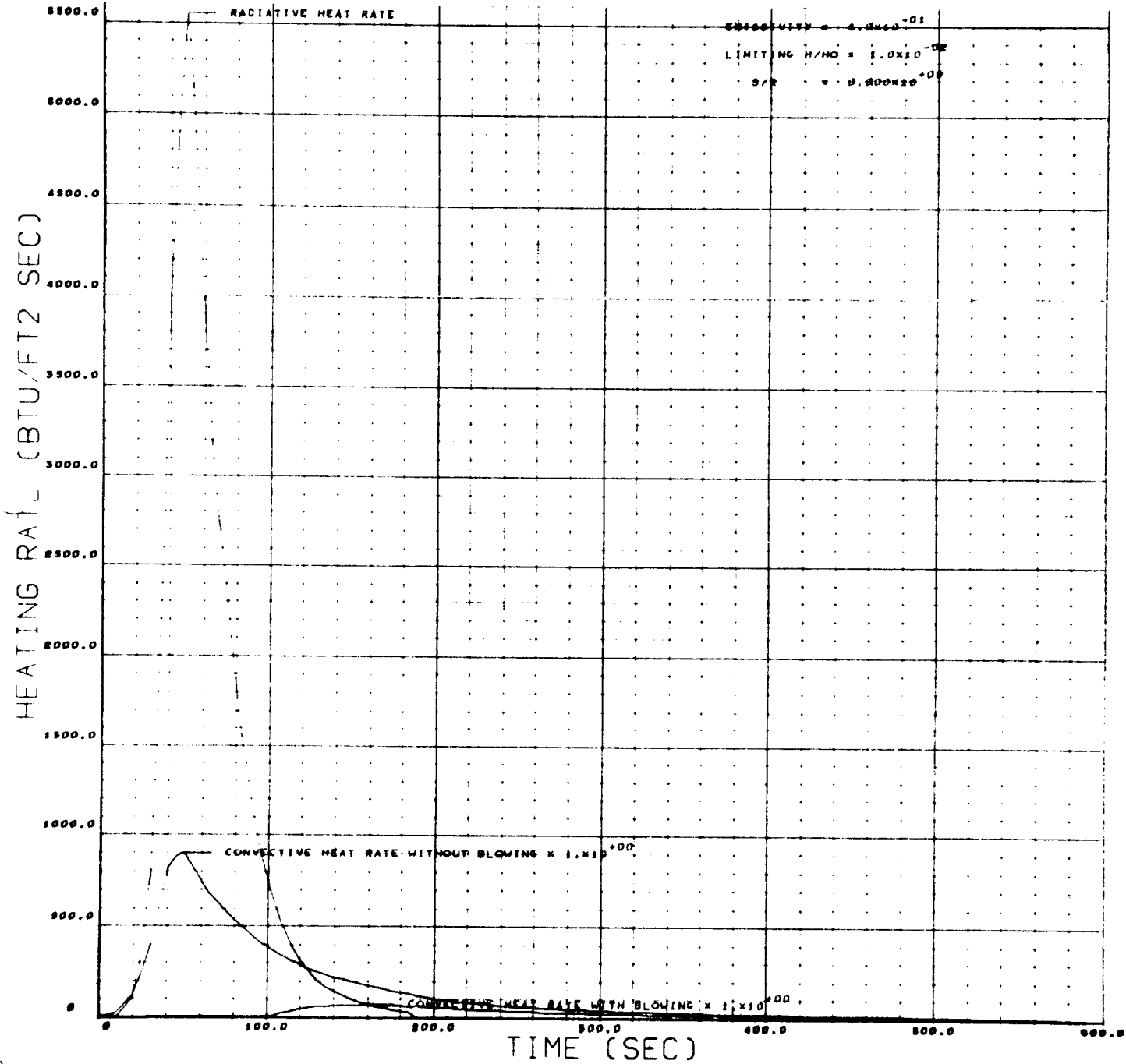


FIGURE A19

MATERIAL RESPONSE DATA

APOLLO SUR LB

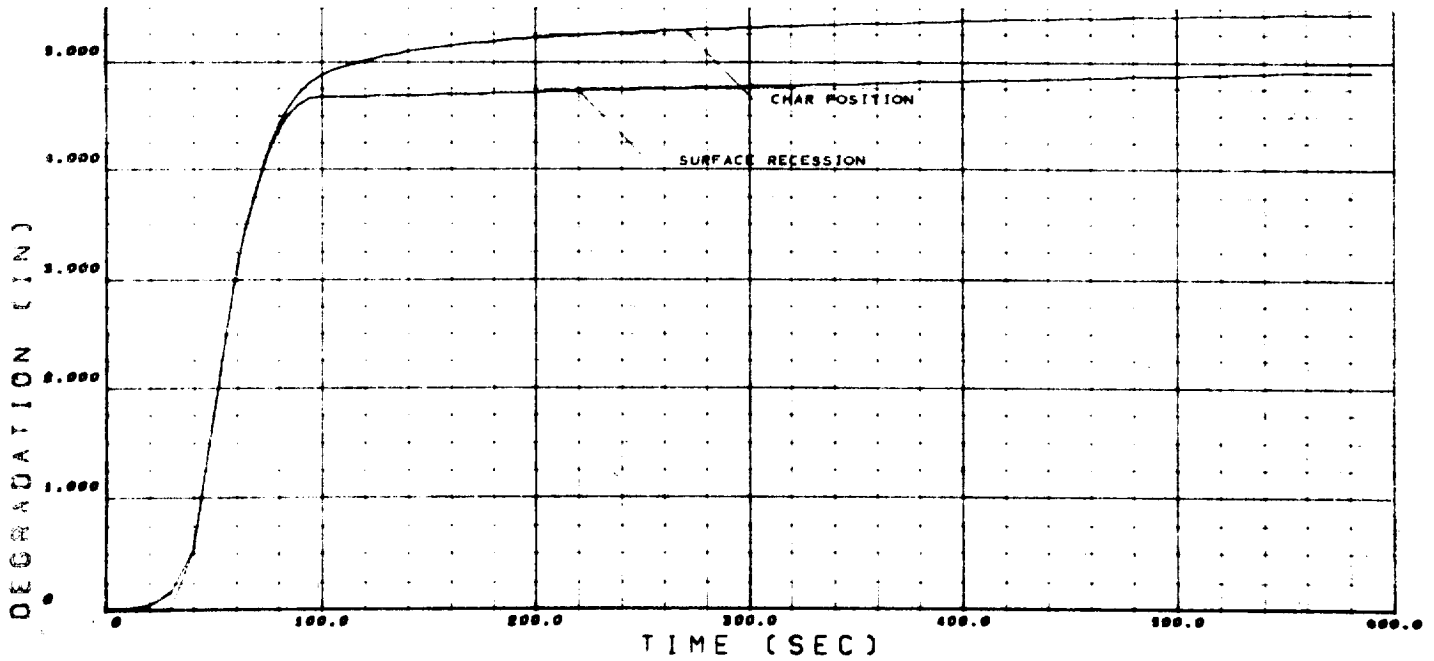
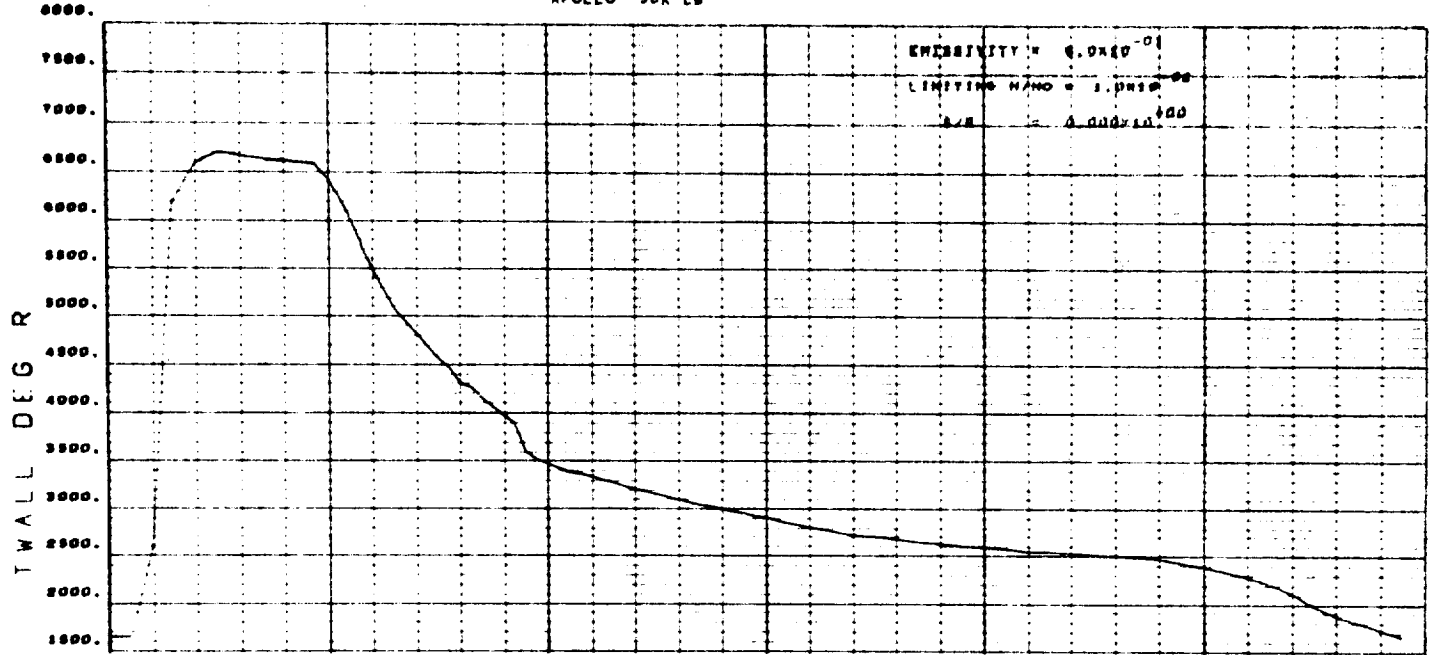


FIGURE A 19

ENERGY ACCOMMODATION MECHANISMS

APOLLO 30R LB

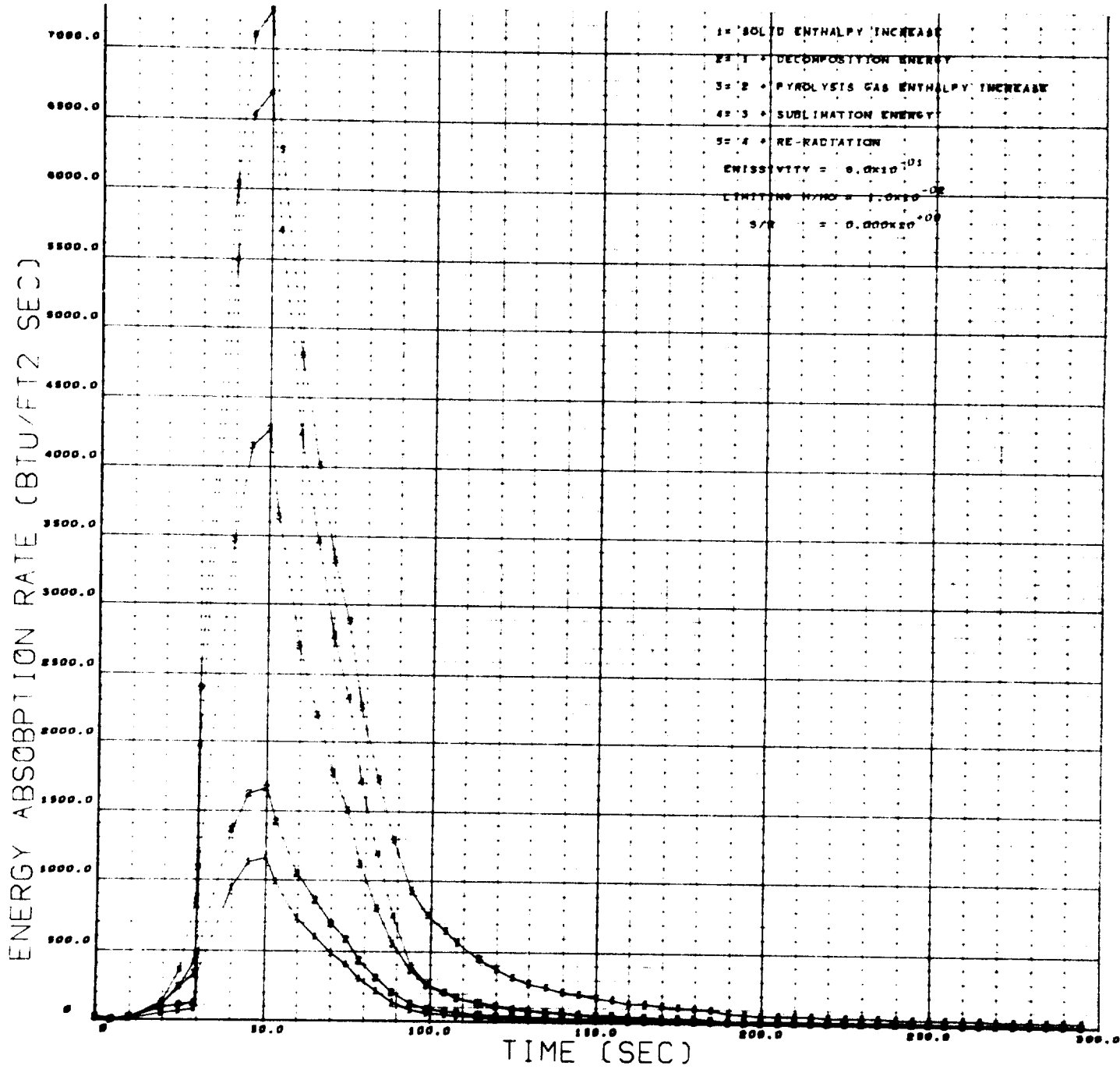


FIGURE A20

HEATING RATE HISTORY

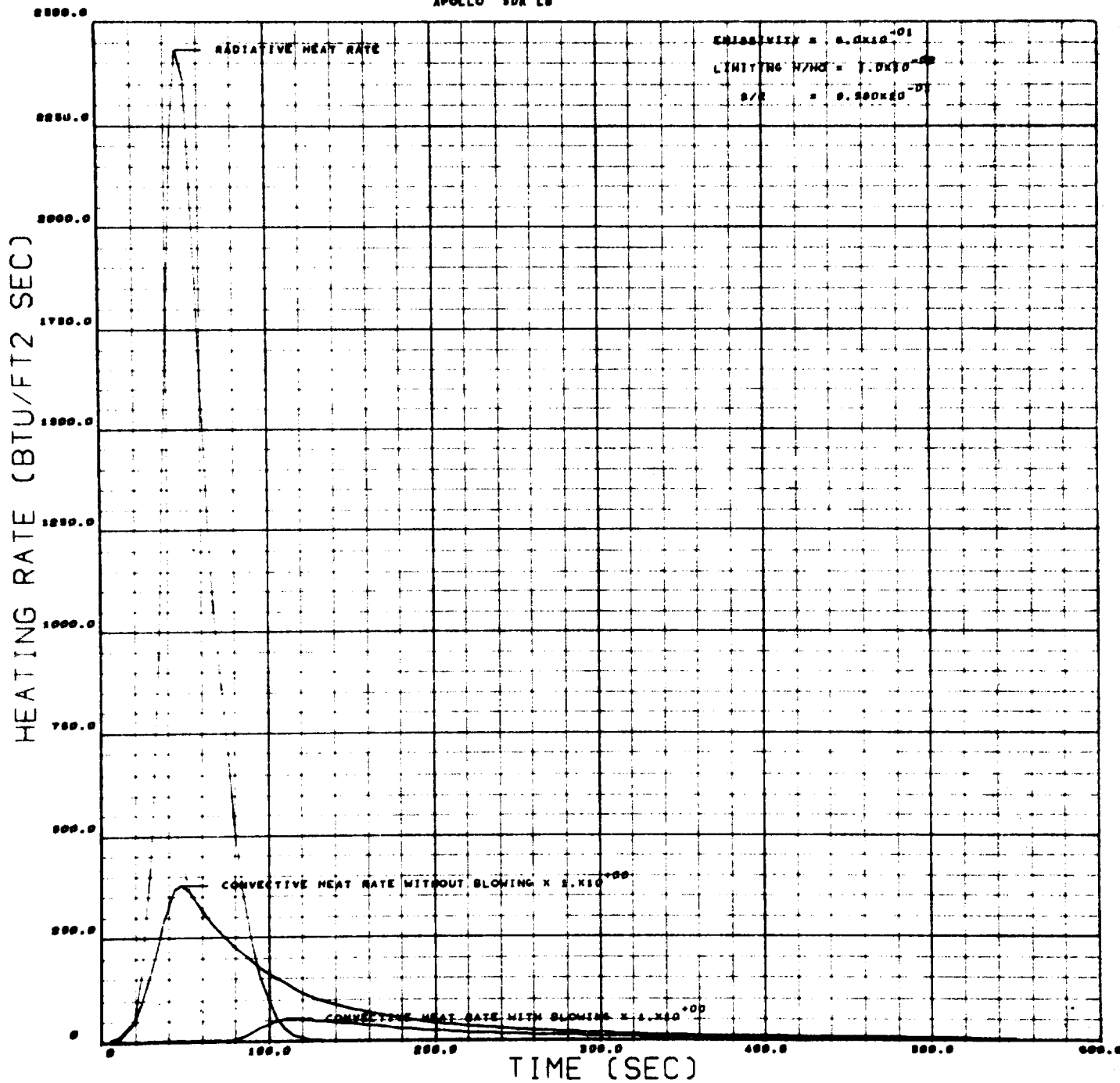


FIGURE A 20

MATERIAL RESPONSE DATA

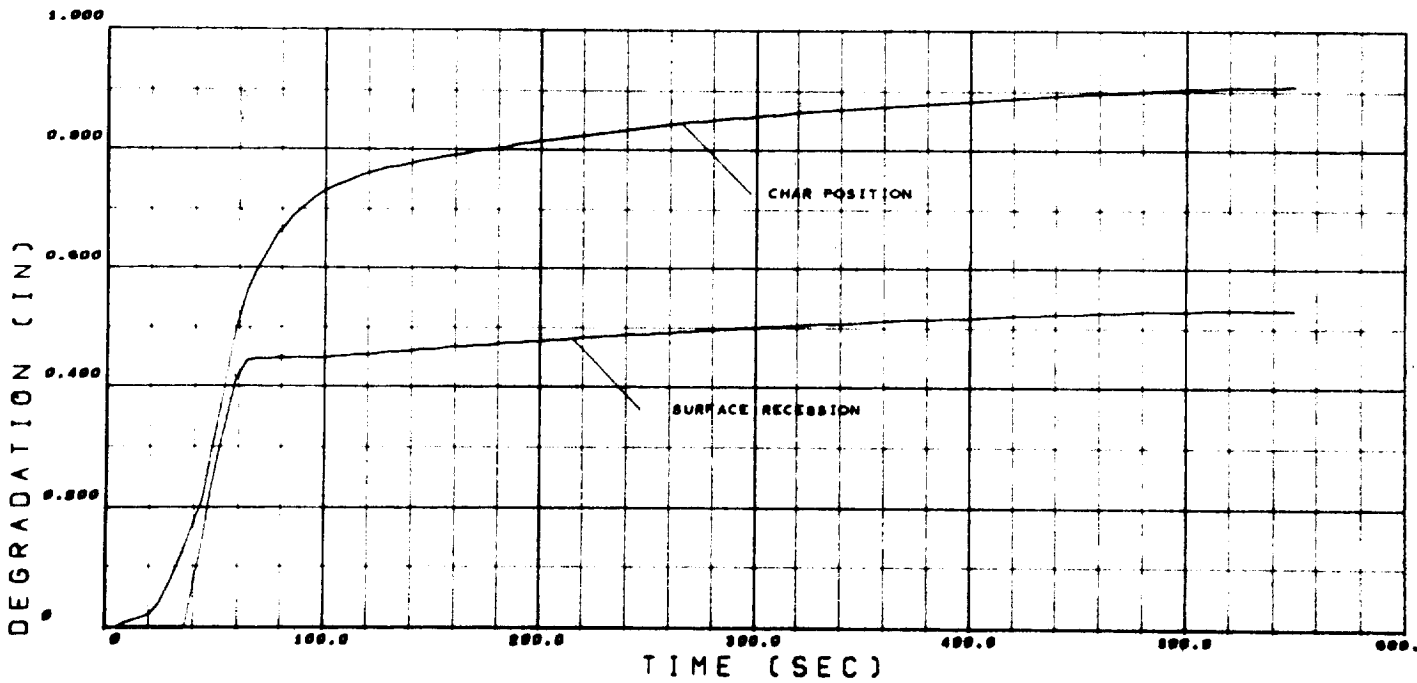
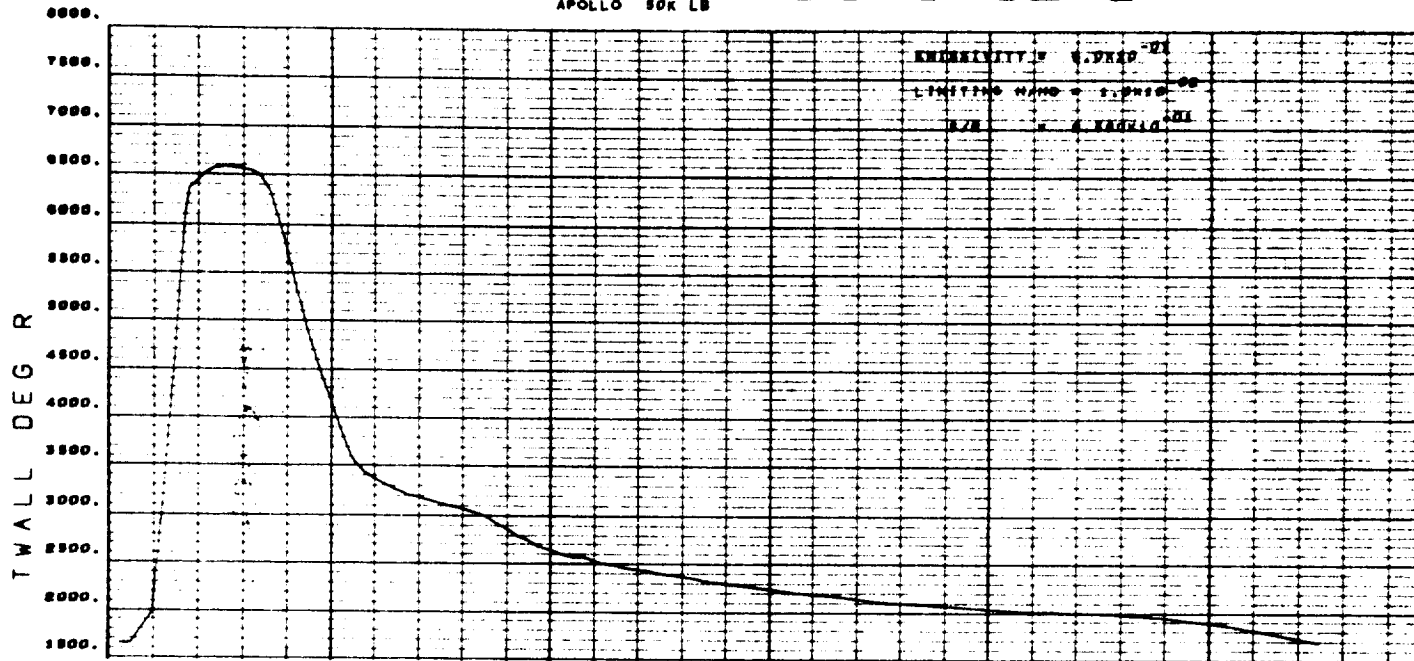


FIGURE A20

ENERGY ACCOMMODATION MECHANISMS

APOLLO 10X LB

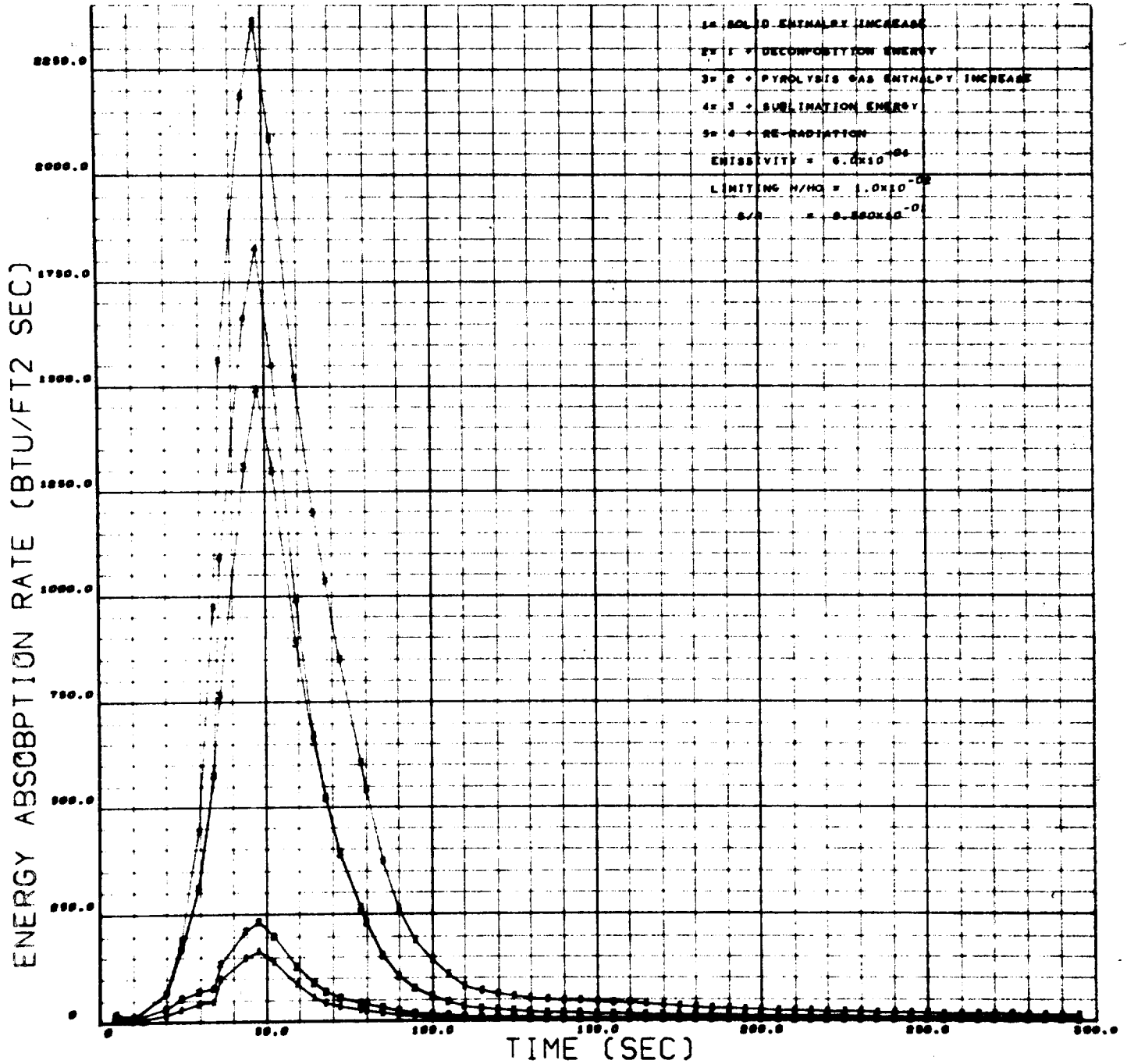


FIGURE A21

HEATING RATE HISTORY

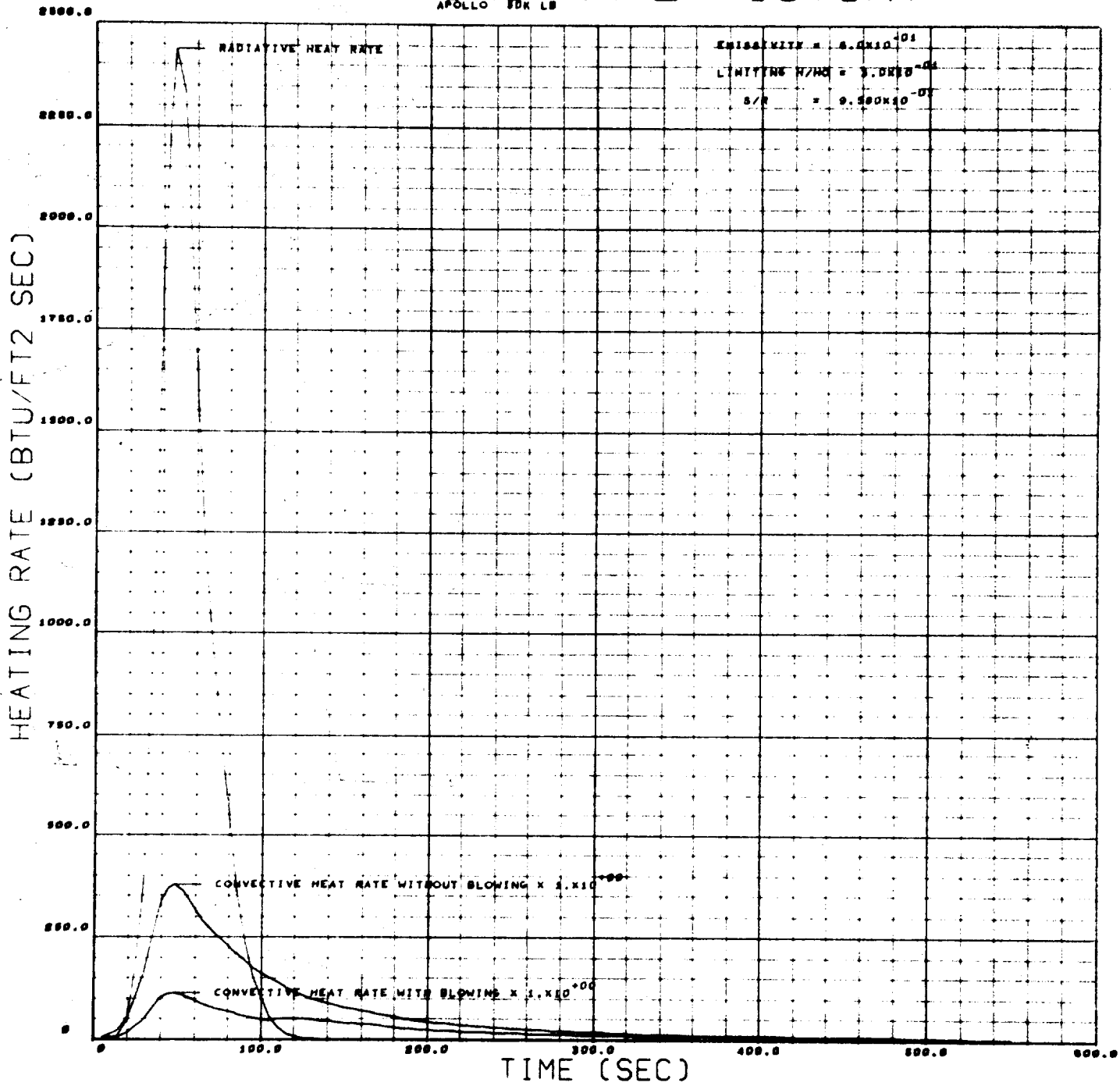


FIGURE A 21

MATERIAL RESPONSE DATA

APOLLO 30K LB

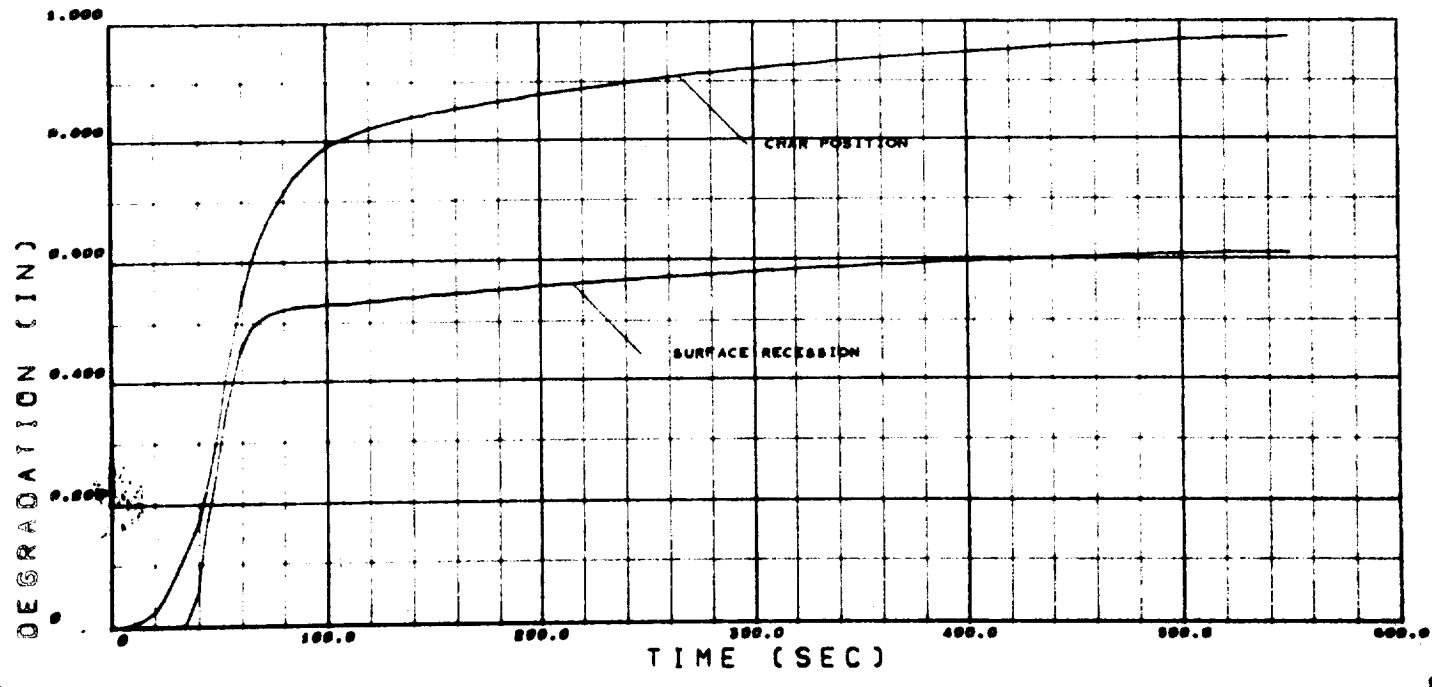
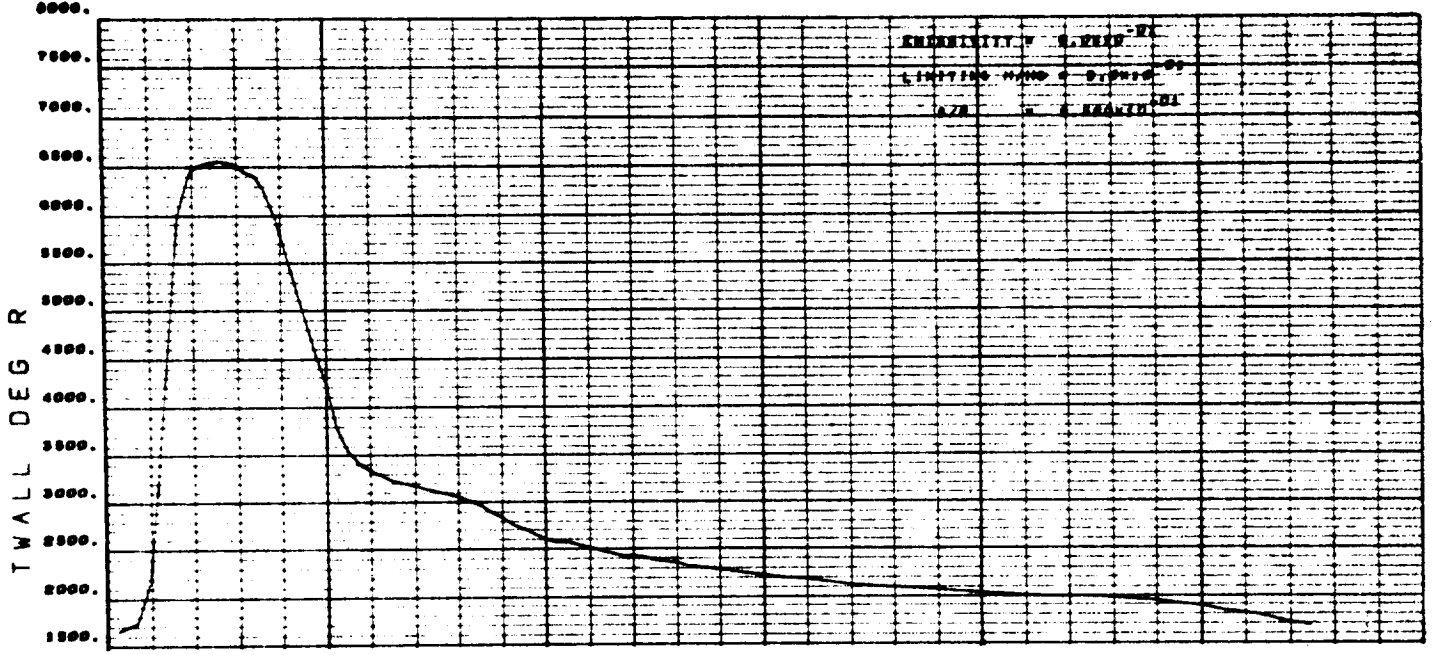


FIGURE A 21

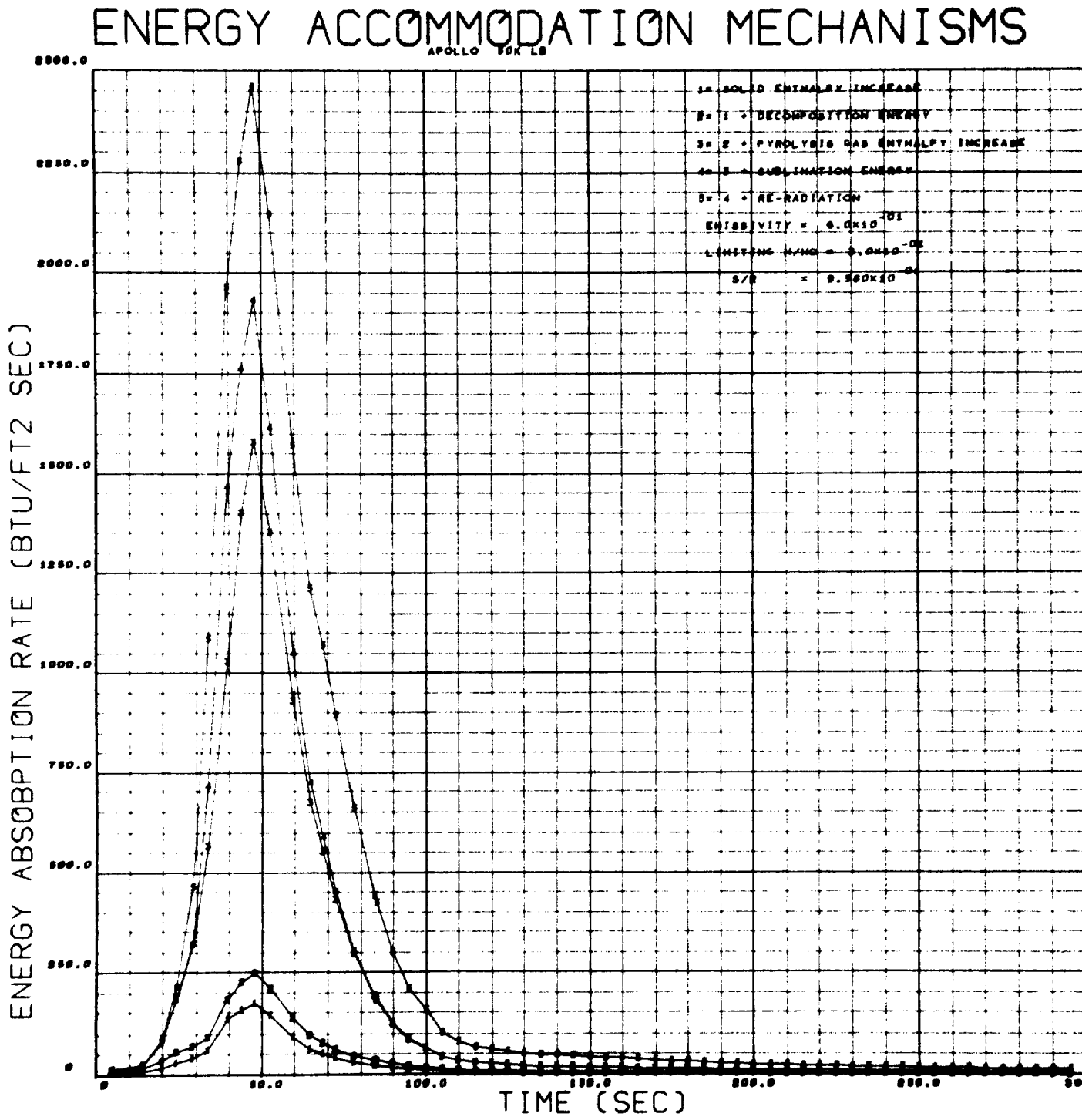
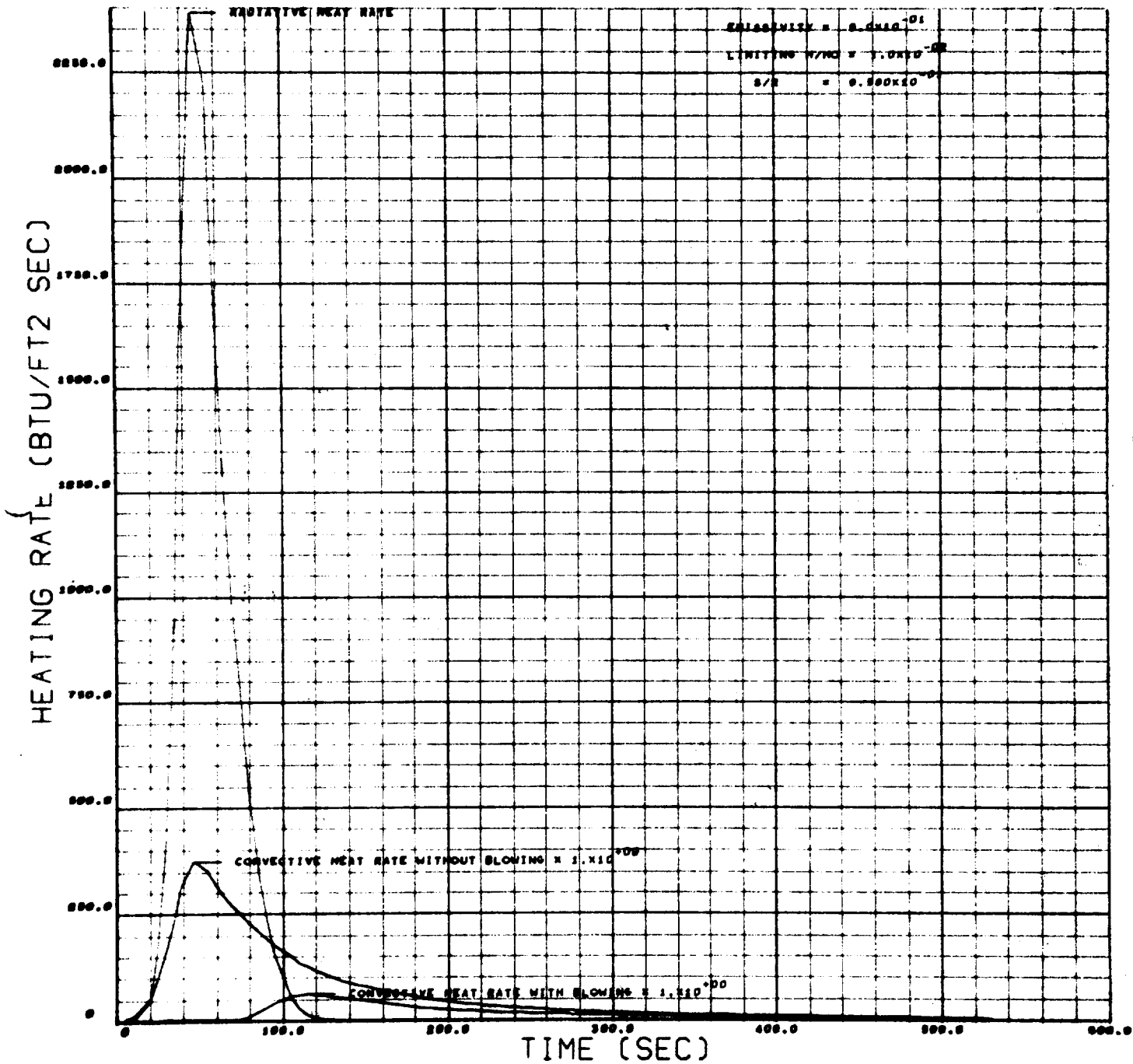


FIGURE A22

HEATING RATE HISTORY

APOLLO FOR LB



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FIGURE A 22

MATERIAL RESPONSE DATA

APOLLO 50K LB

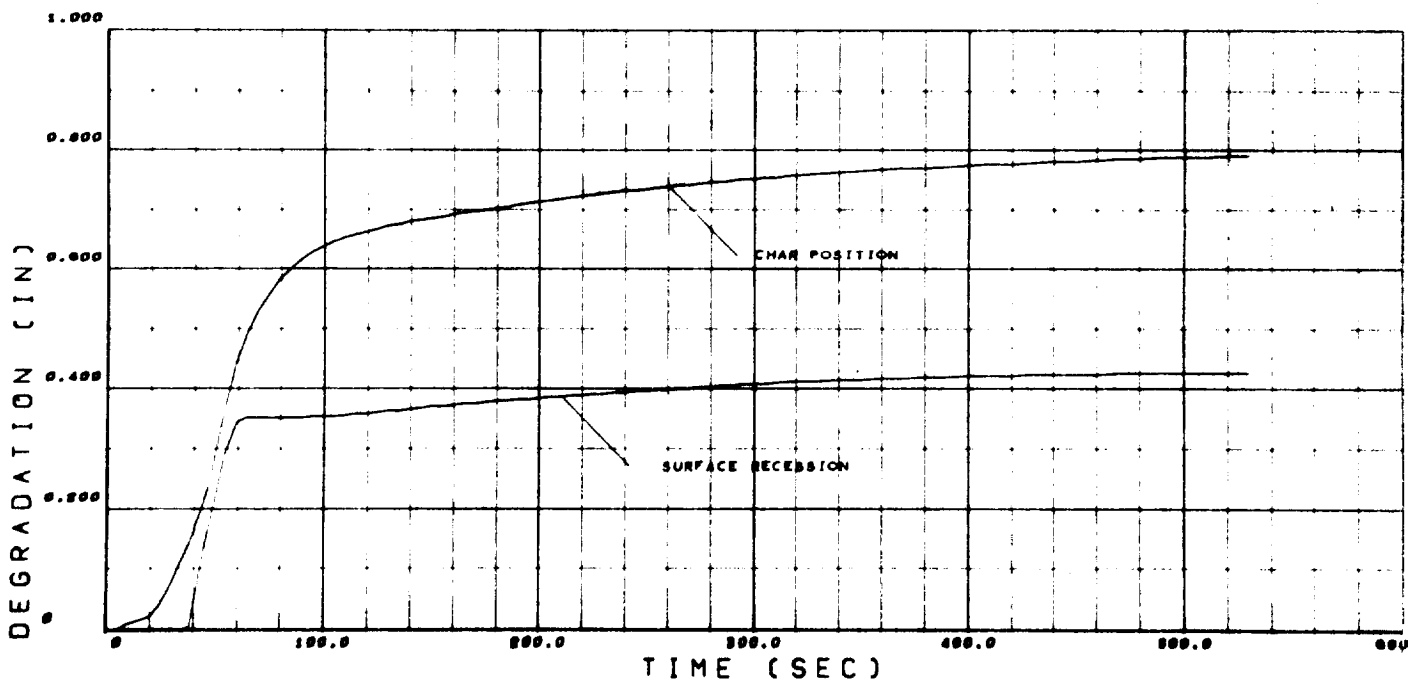
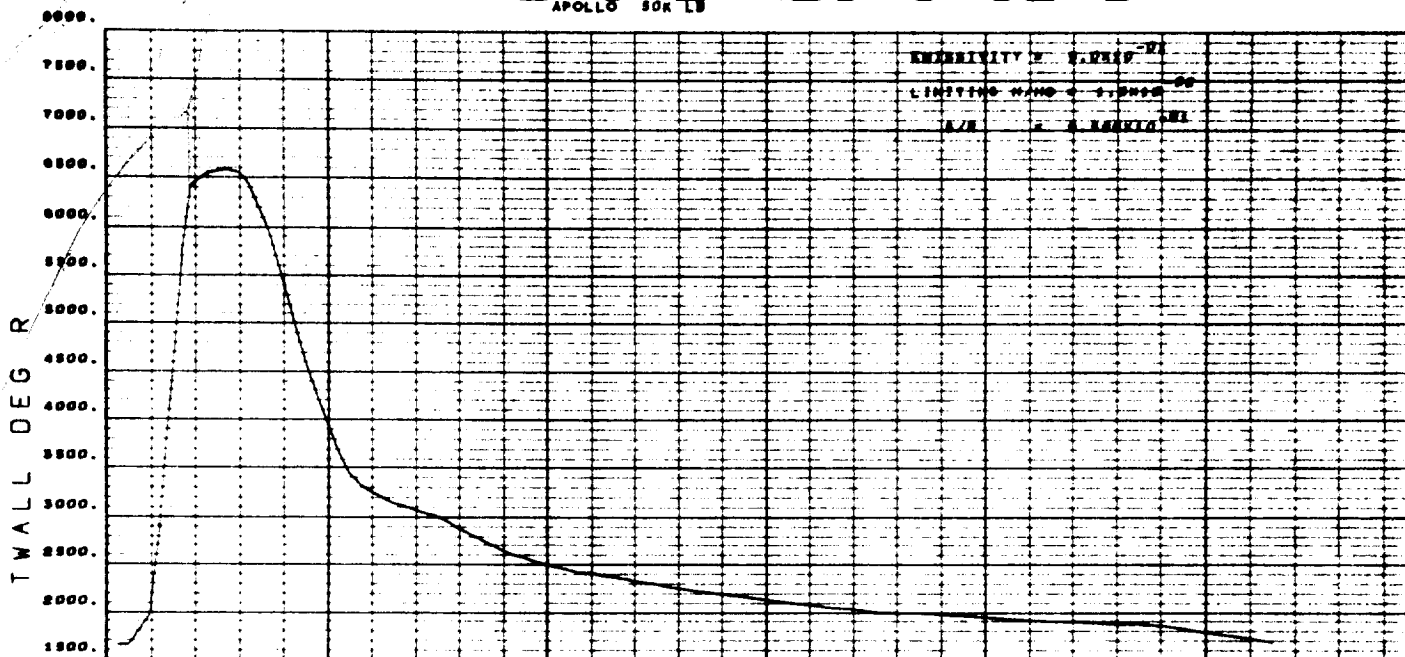


FIGURE A 22

ENERGY ACCOMMODATION MECHANISMS

APOLLO 10R LB

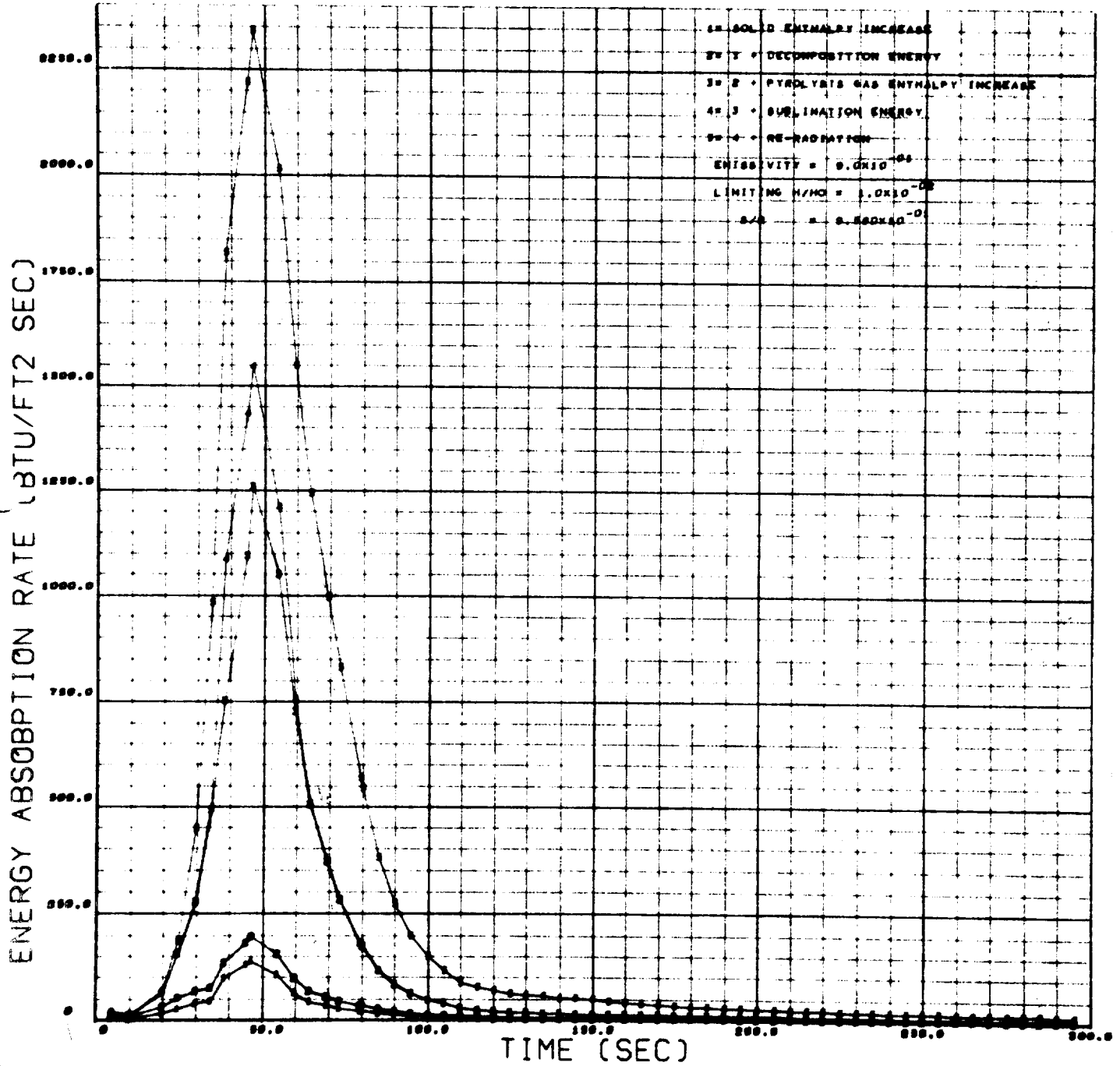


FIGURE A 23

HEATING RATE HISTORY

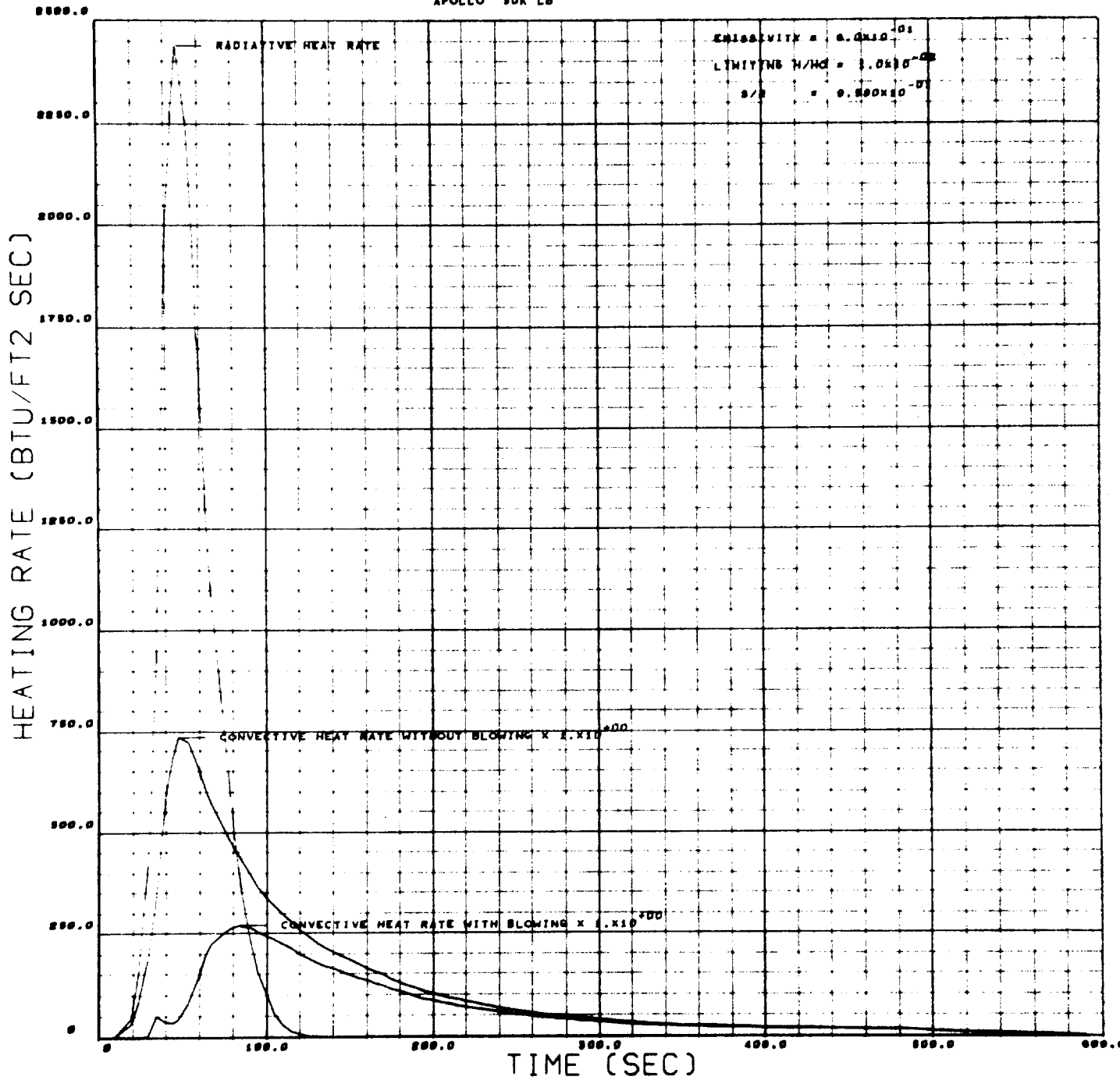


FIGURE A 23

MATERIAL RESPONSE DATA

APOLLO 50K LB

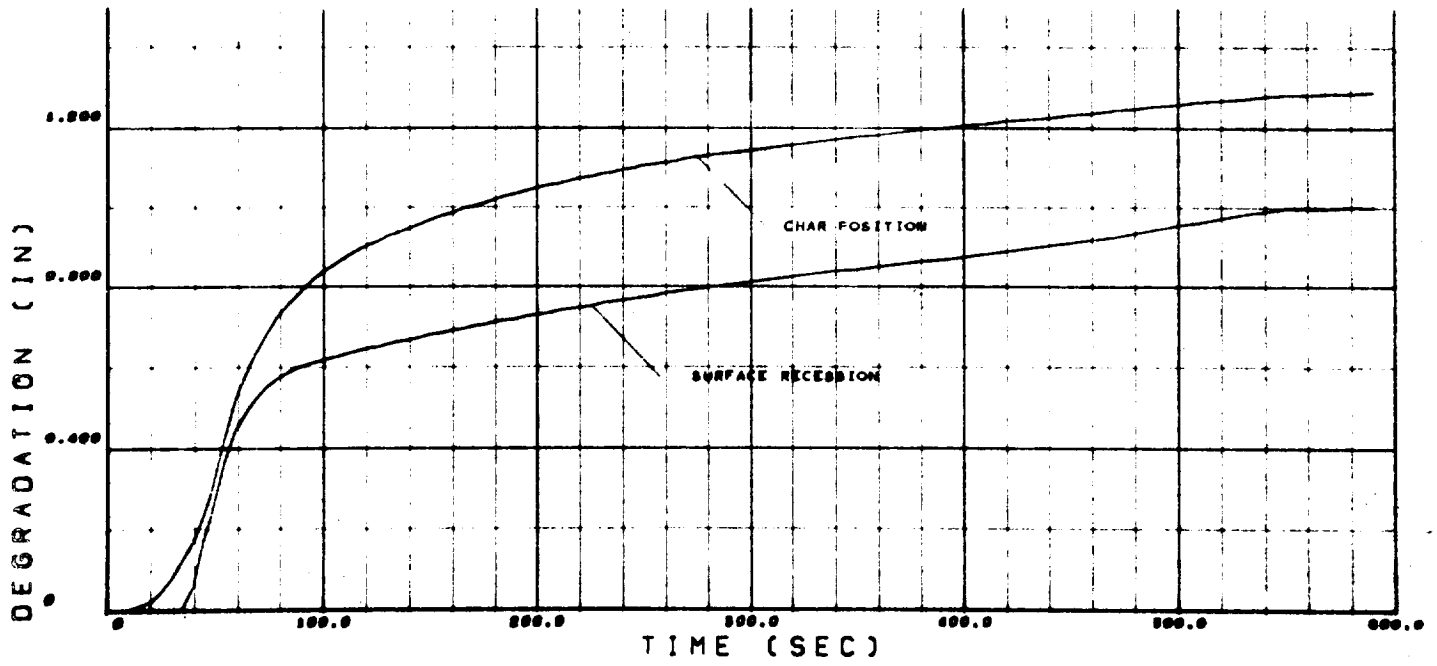
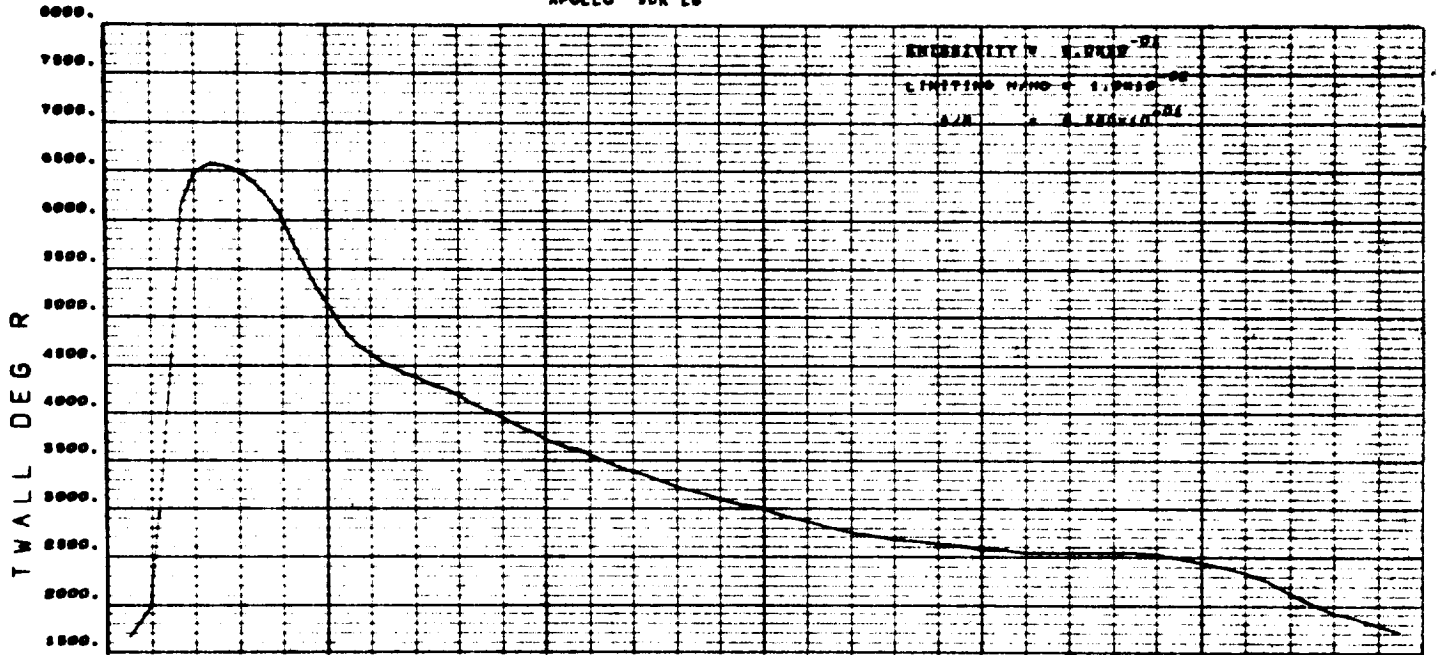


FIGURE A 23

ENERGY ACCOMMODATION MECHANISMS

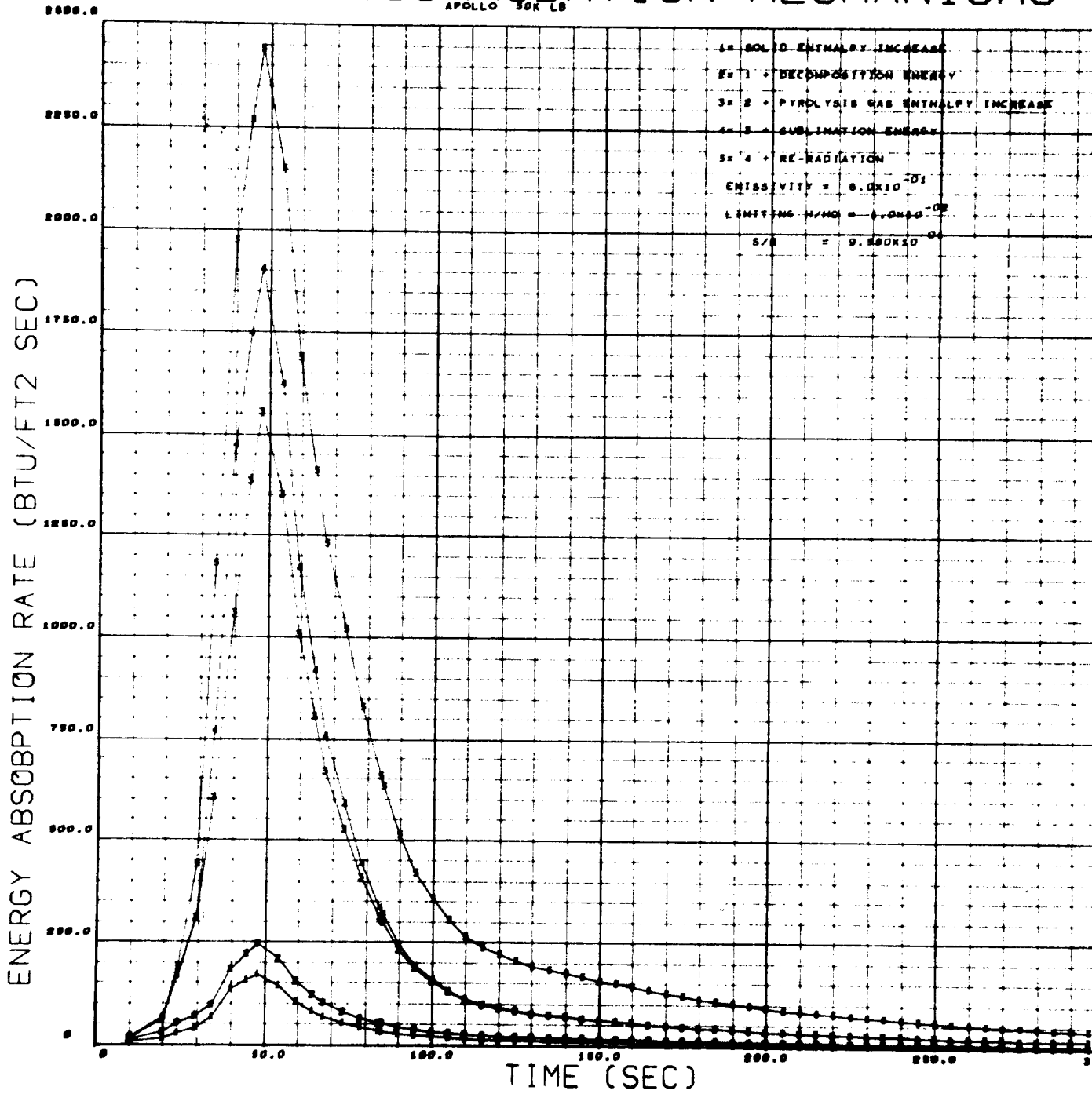


FIGURE A 24

HEATING RATE HISTORY

APOLLO 10K LB

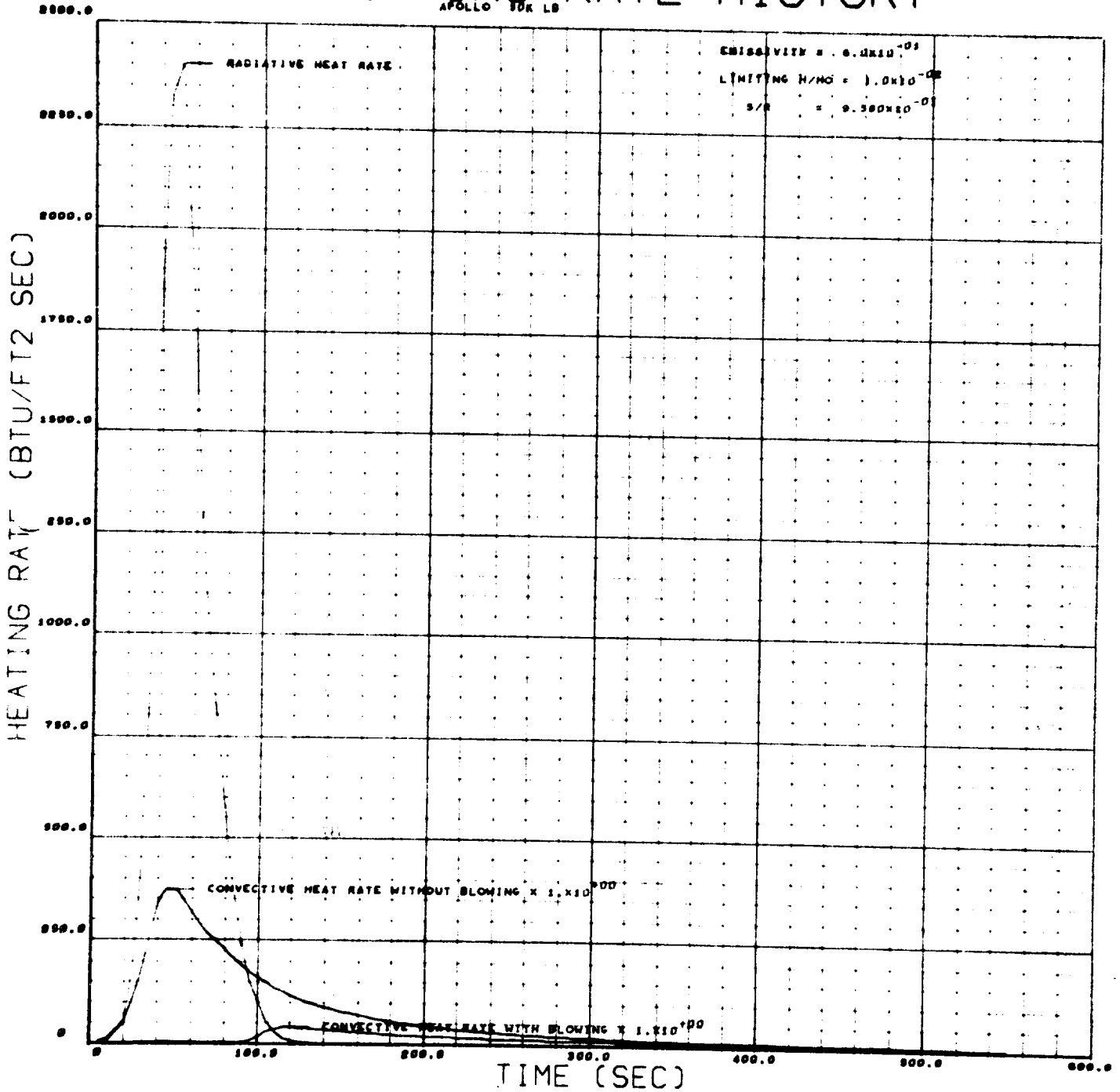


FIGURE A 24

MATERIAL RESPONSE DATA

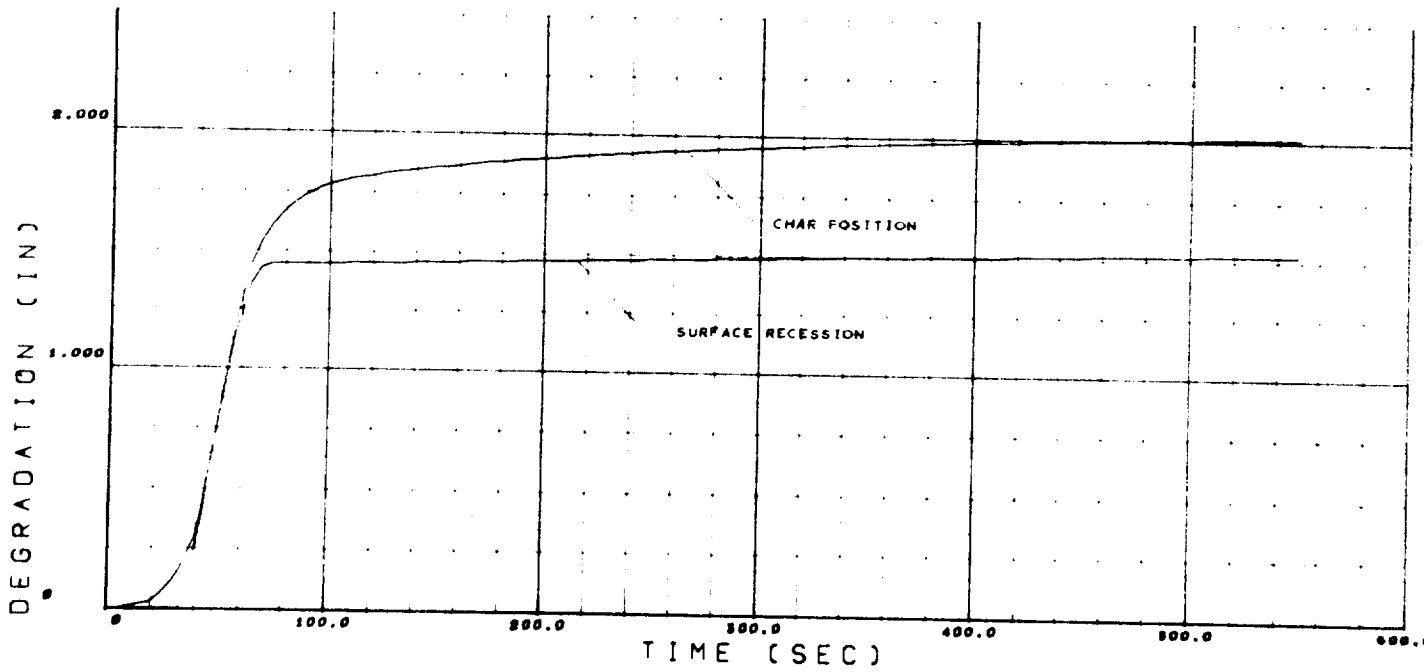
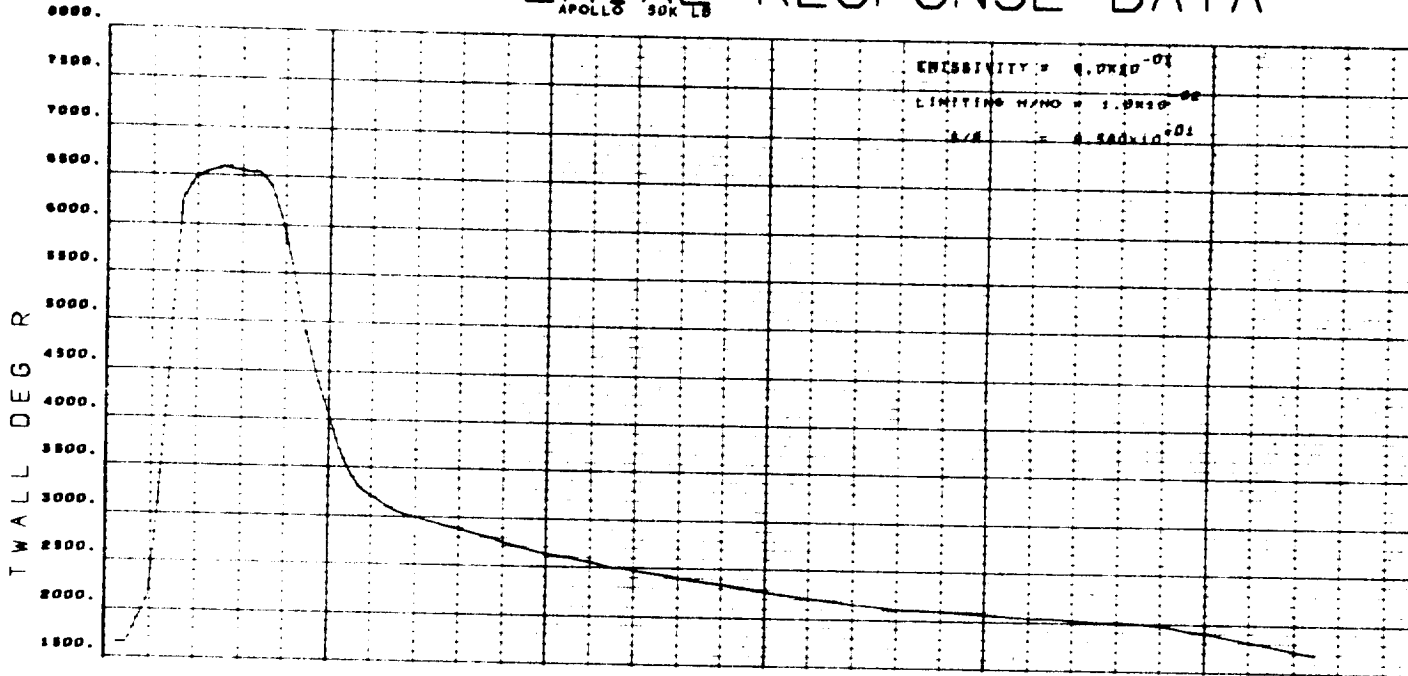


FIGURE A 24

ENERGY ACCOMMODATION MECHANISMS

APOLLO 3DR LB

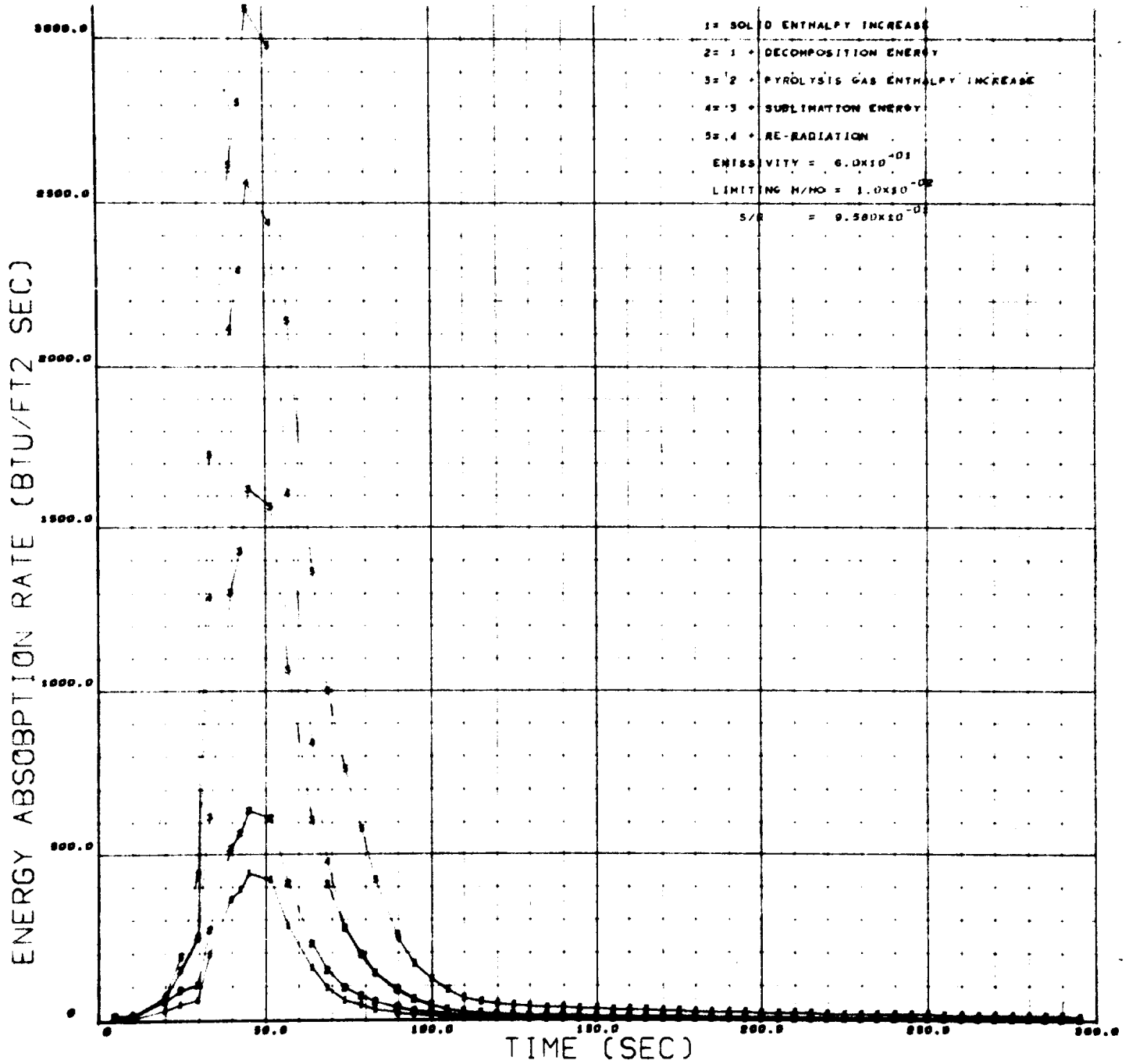


FIGURE A 25

HEATING RATE HISTORY

APOLLO 30K LB

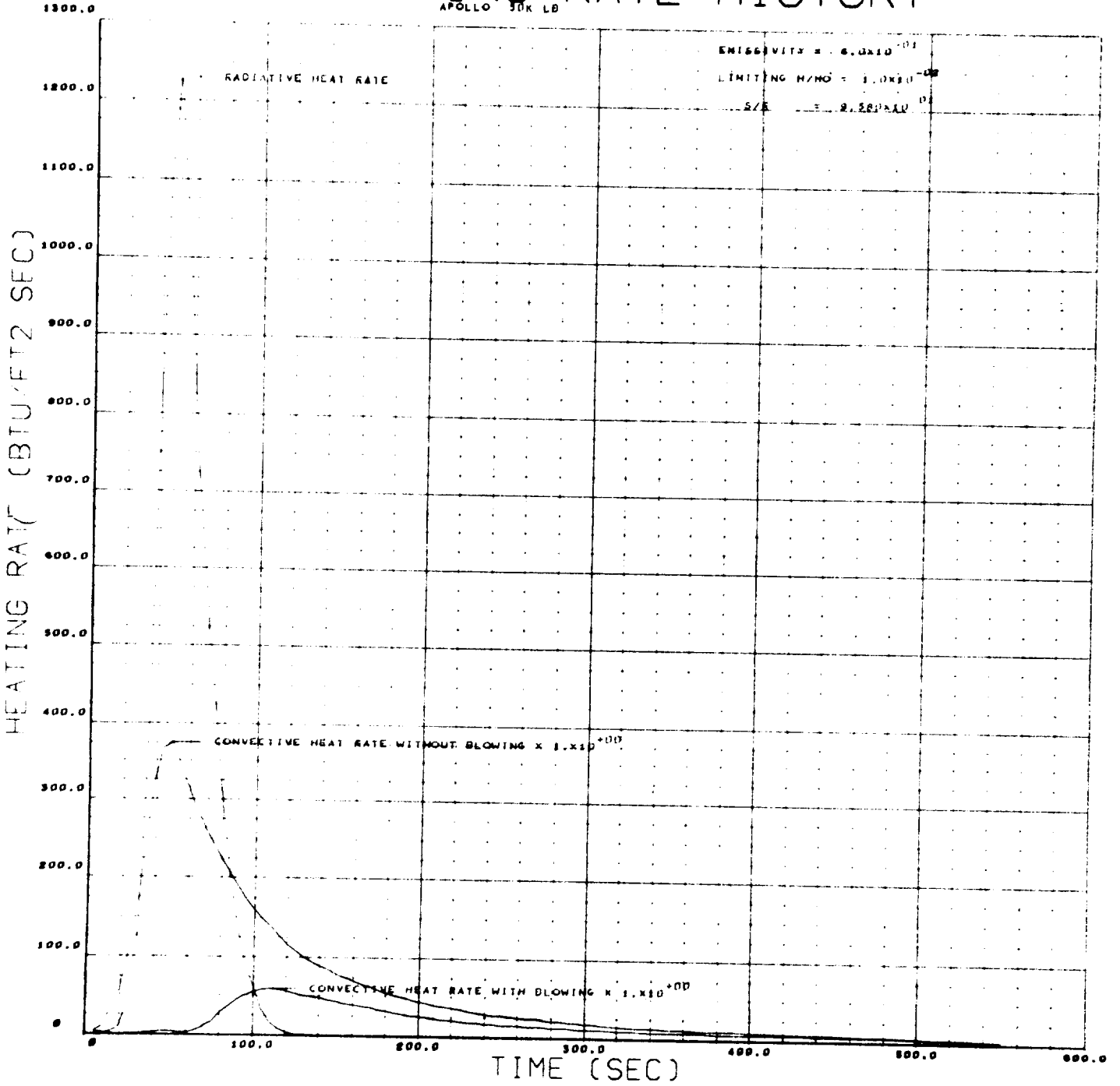


FIGURE A 25

MATERIAL RESPONSE DATA

APOLLO 50K LB

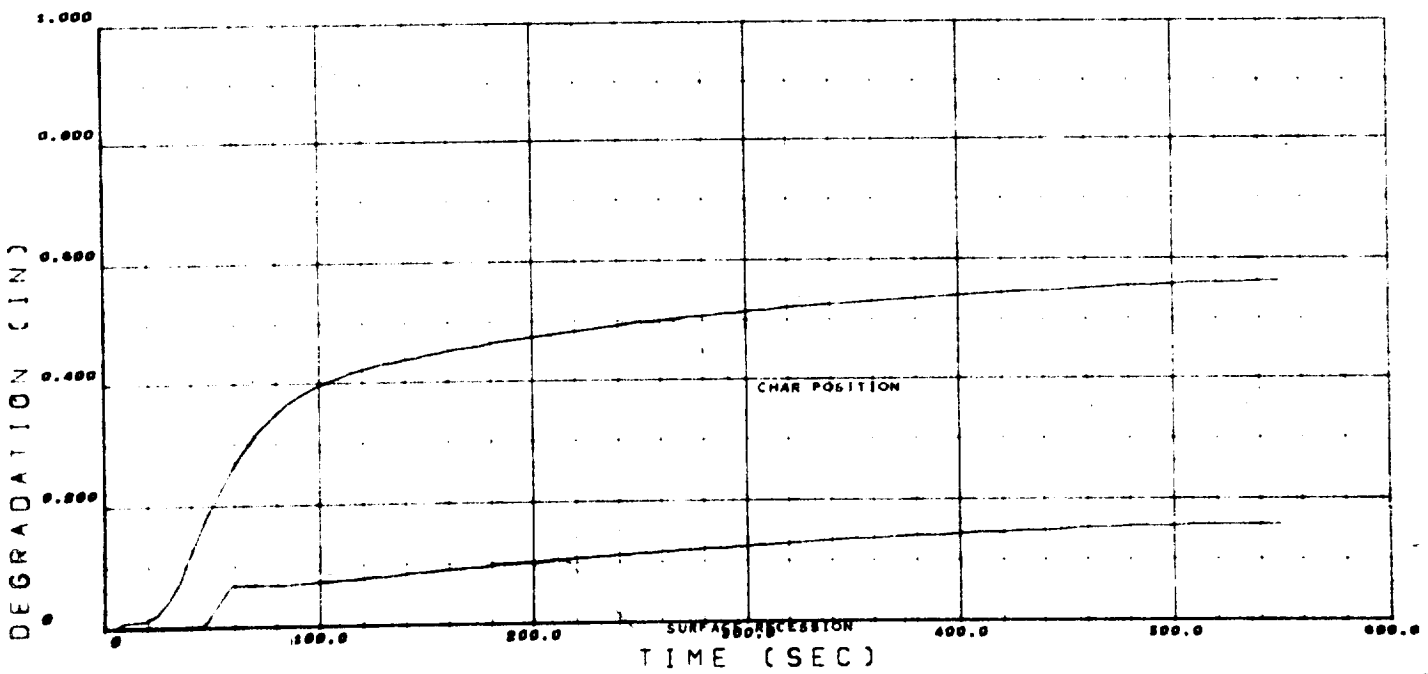
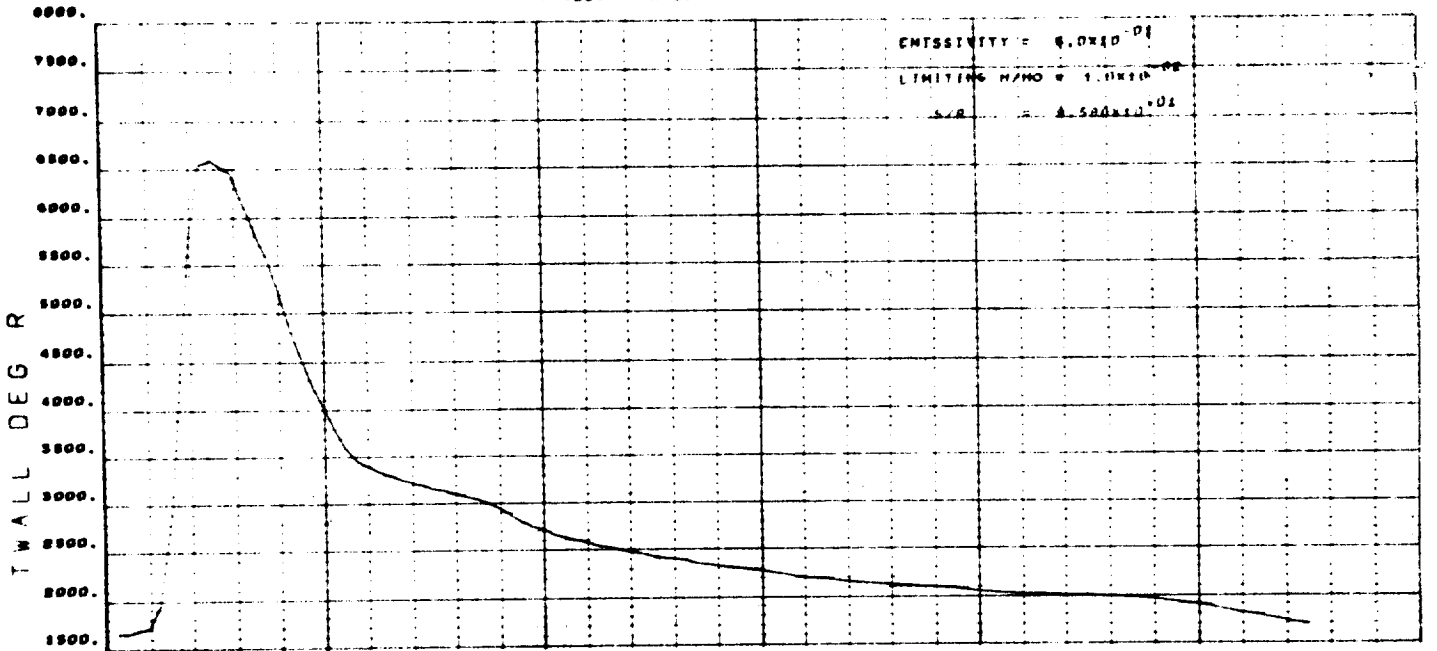


FIGURE A 25

ENERGY ACCOMMODATION MECHANISMS

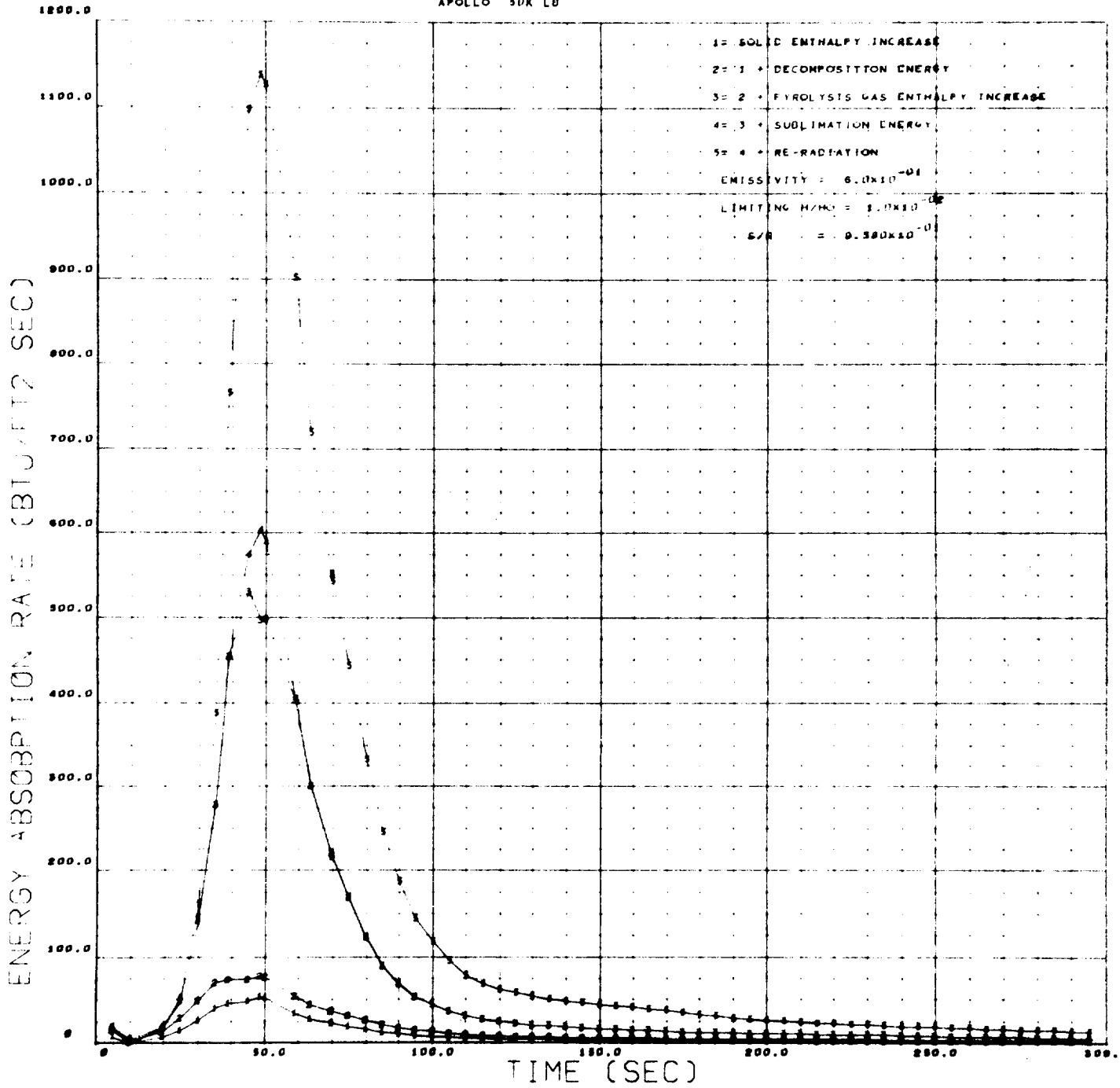


FIGURE A 26

HEATING RATE HISTORY

APOLLO 17A LB

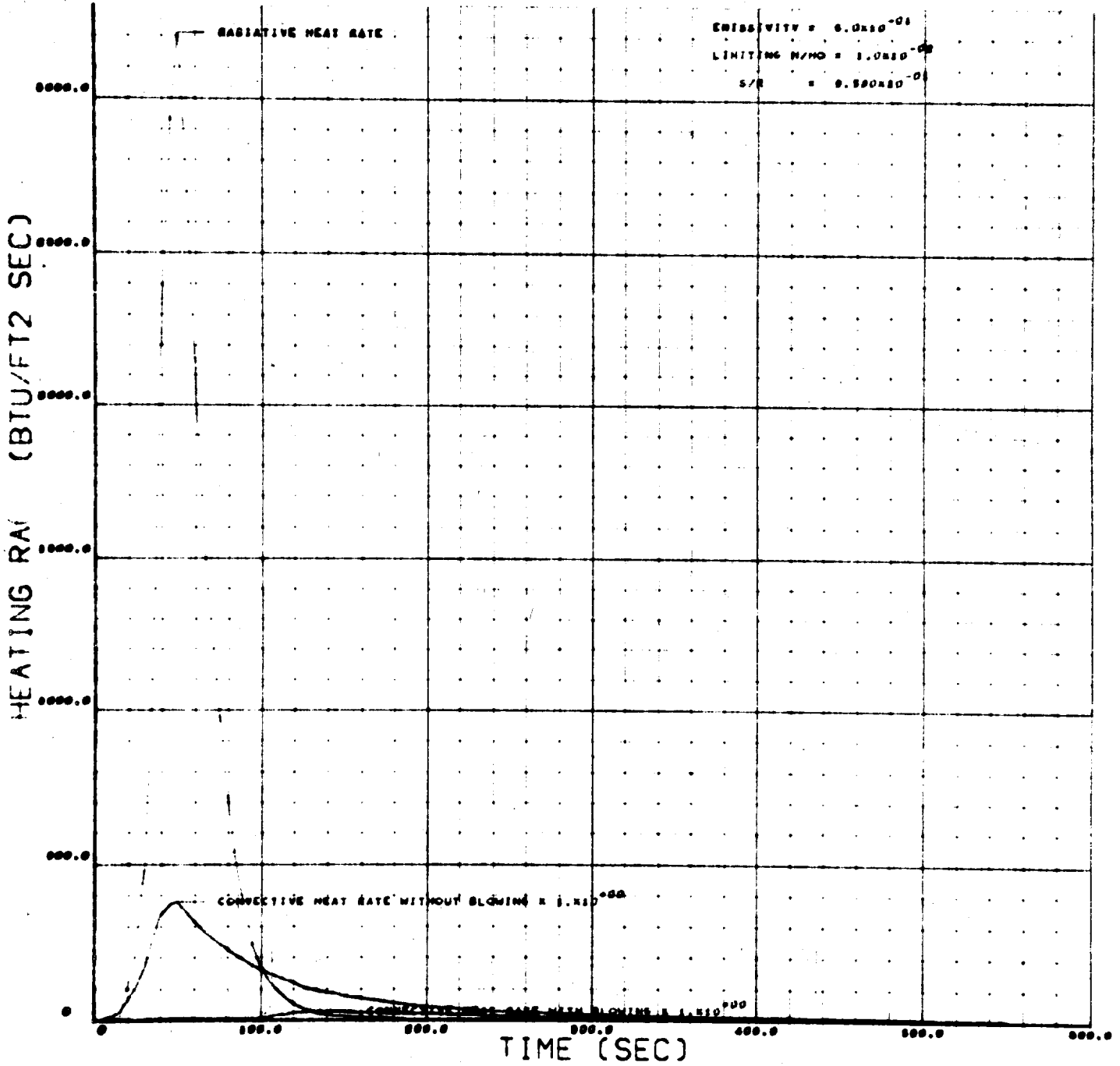


FIGURE A 26

MATERIAL RESPONSE DATA

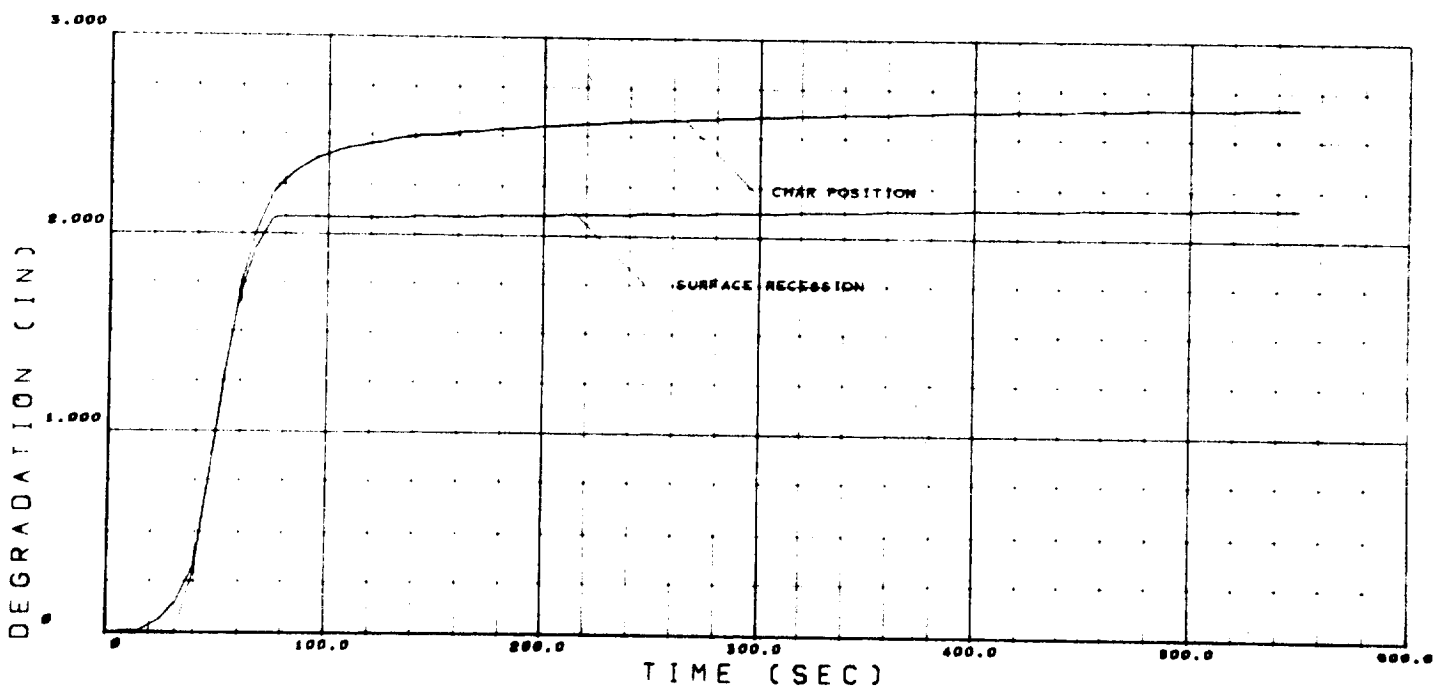
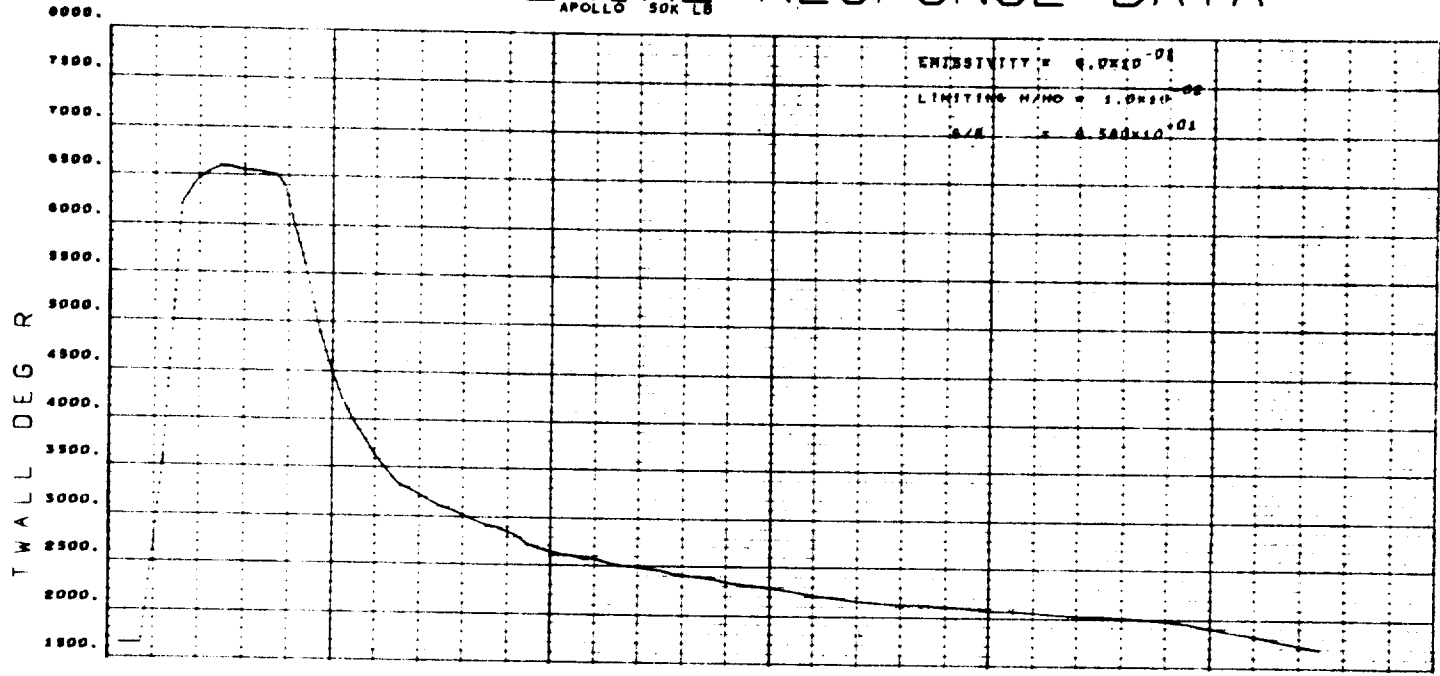


FIGURE A 26

ENERGY ACCOMMODATION MECHANISMS

APOLLO 30X LB

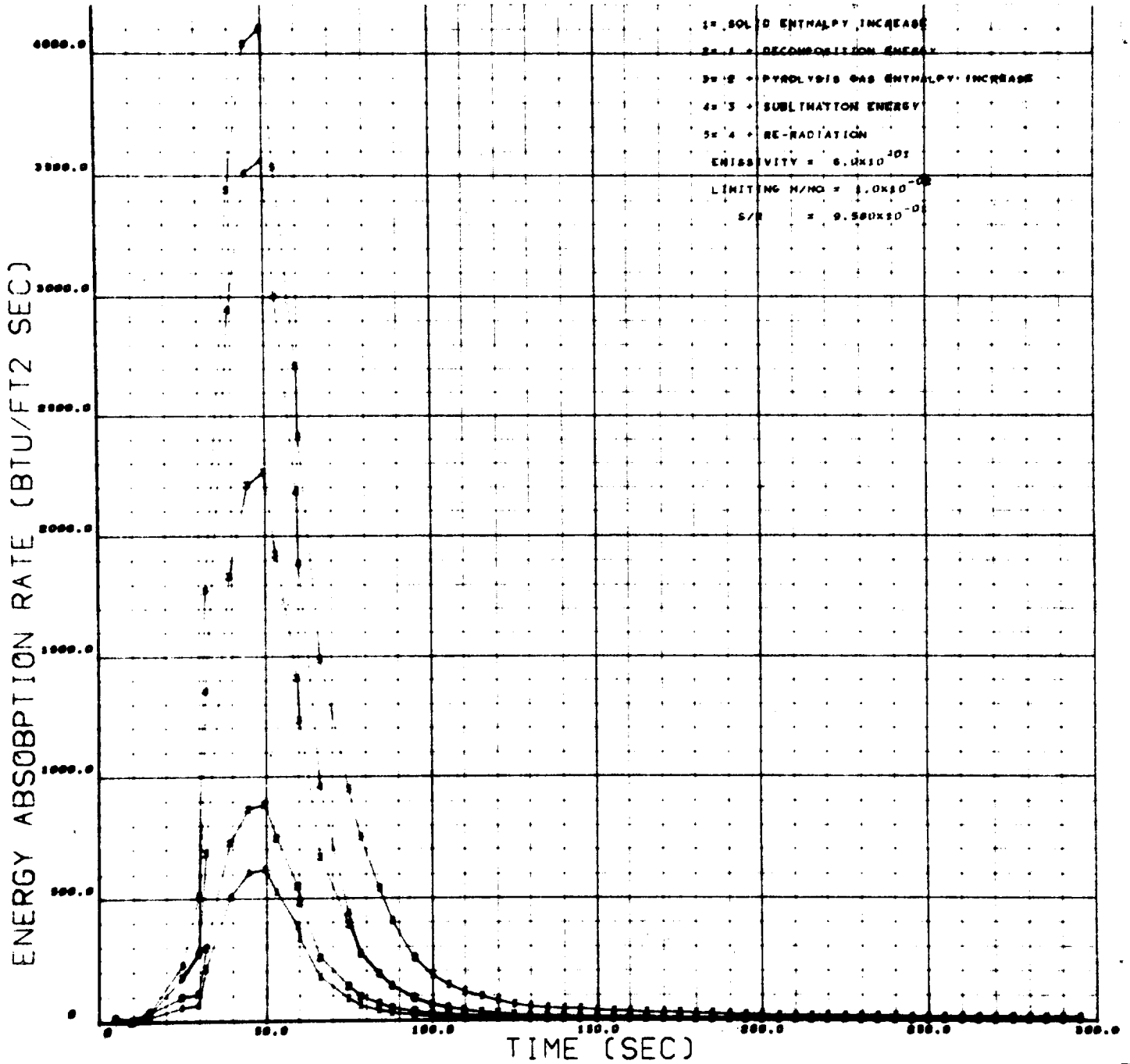


FIGURE A 27

HEATING RATE HISTORY

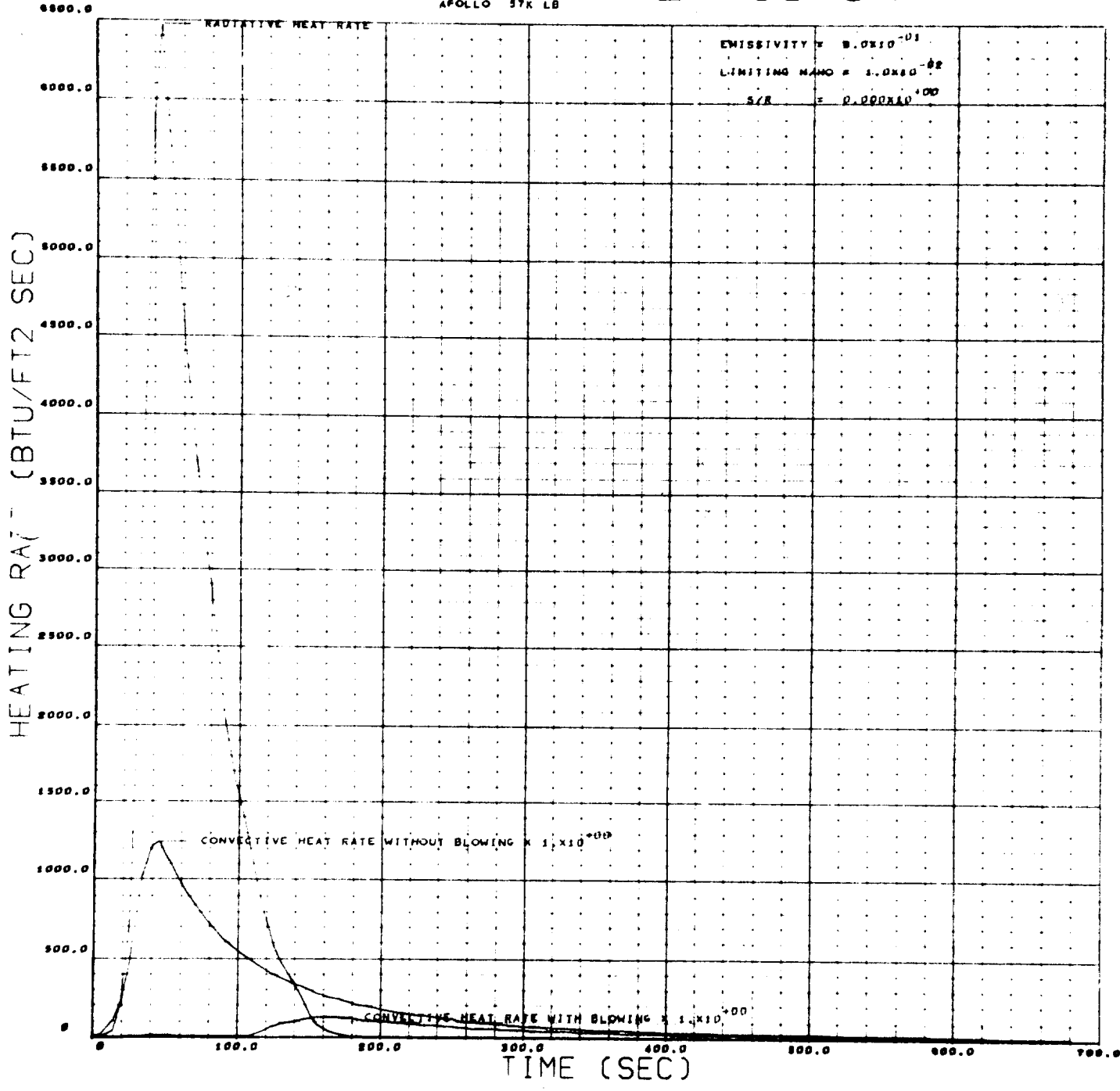
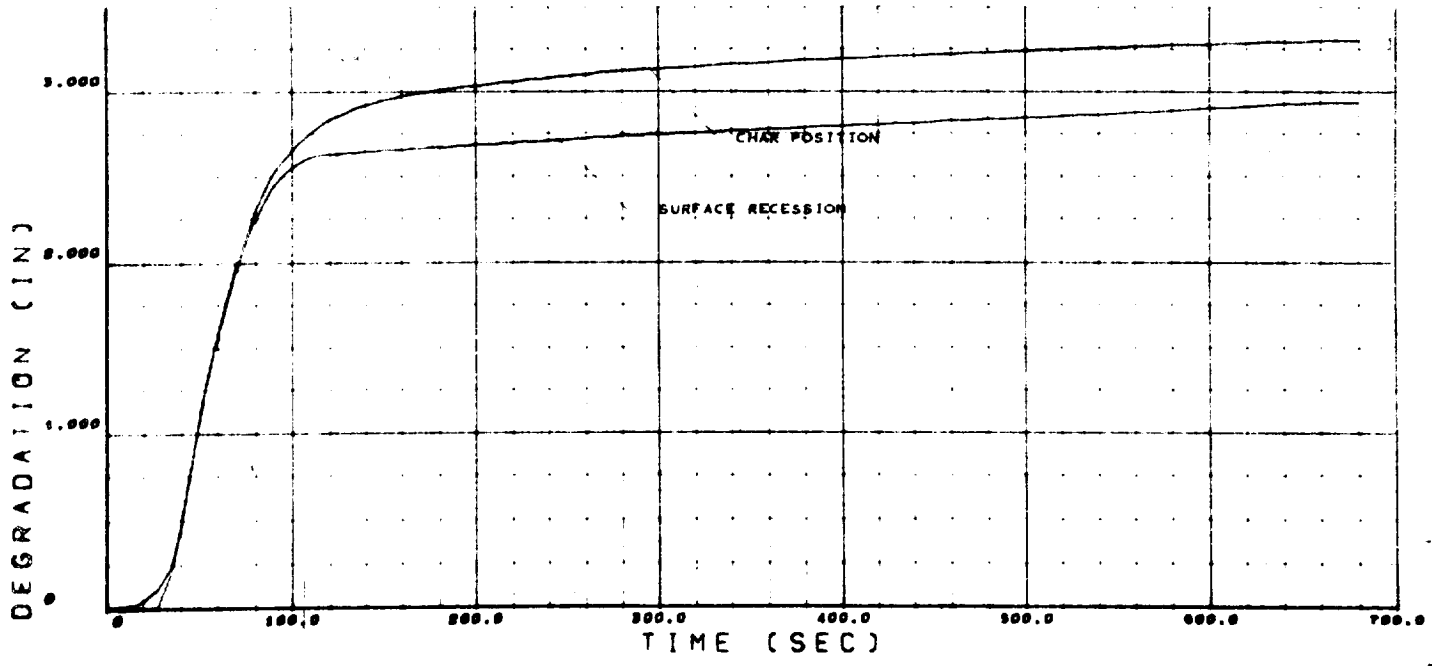
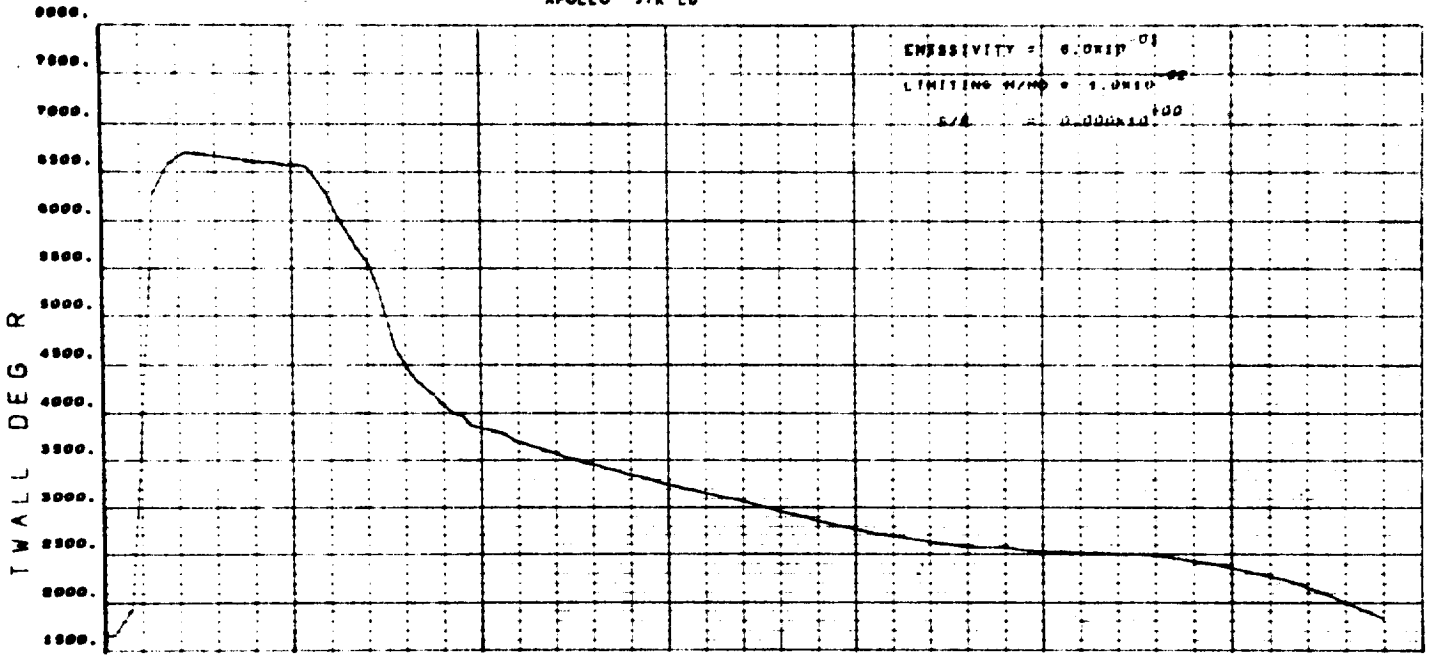


FIGURE A 27

MATERIAL RESPONSE DATA

APOLLO 57K LB

SENSITIVITY = 0.001P 01
LIMITING W/MO = 1.00E 02
S/A = 0.00001E 100



80

FIGURE A 27

ENERGY ACCOMMODATION MECHANISMS

APOLLO 37K LB

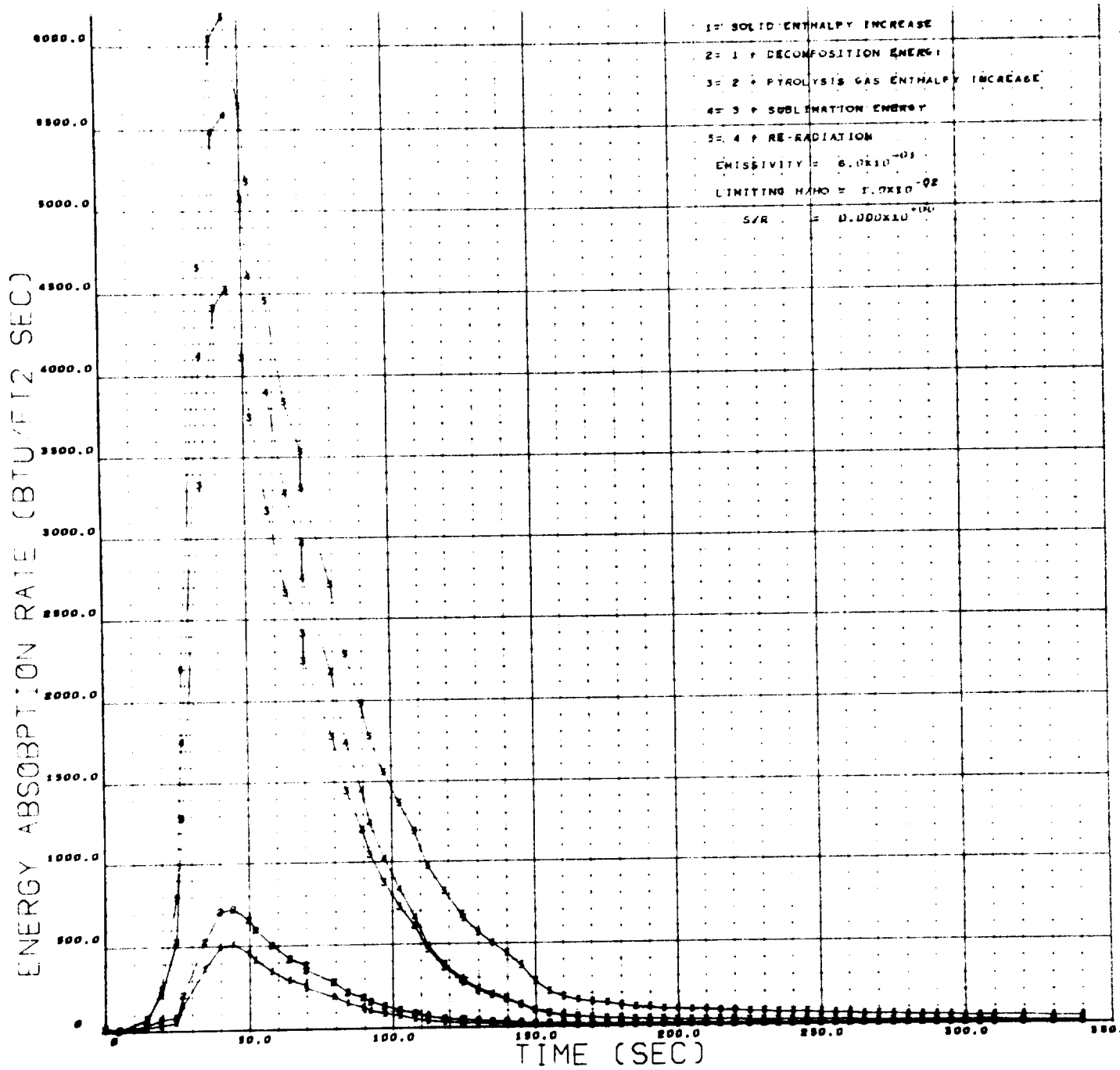


FIGURE A 28

HEATING RATE HISTORY

APOLLO 37K LB

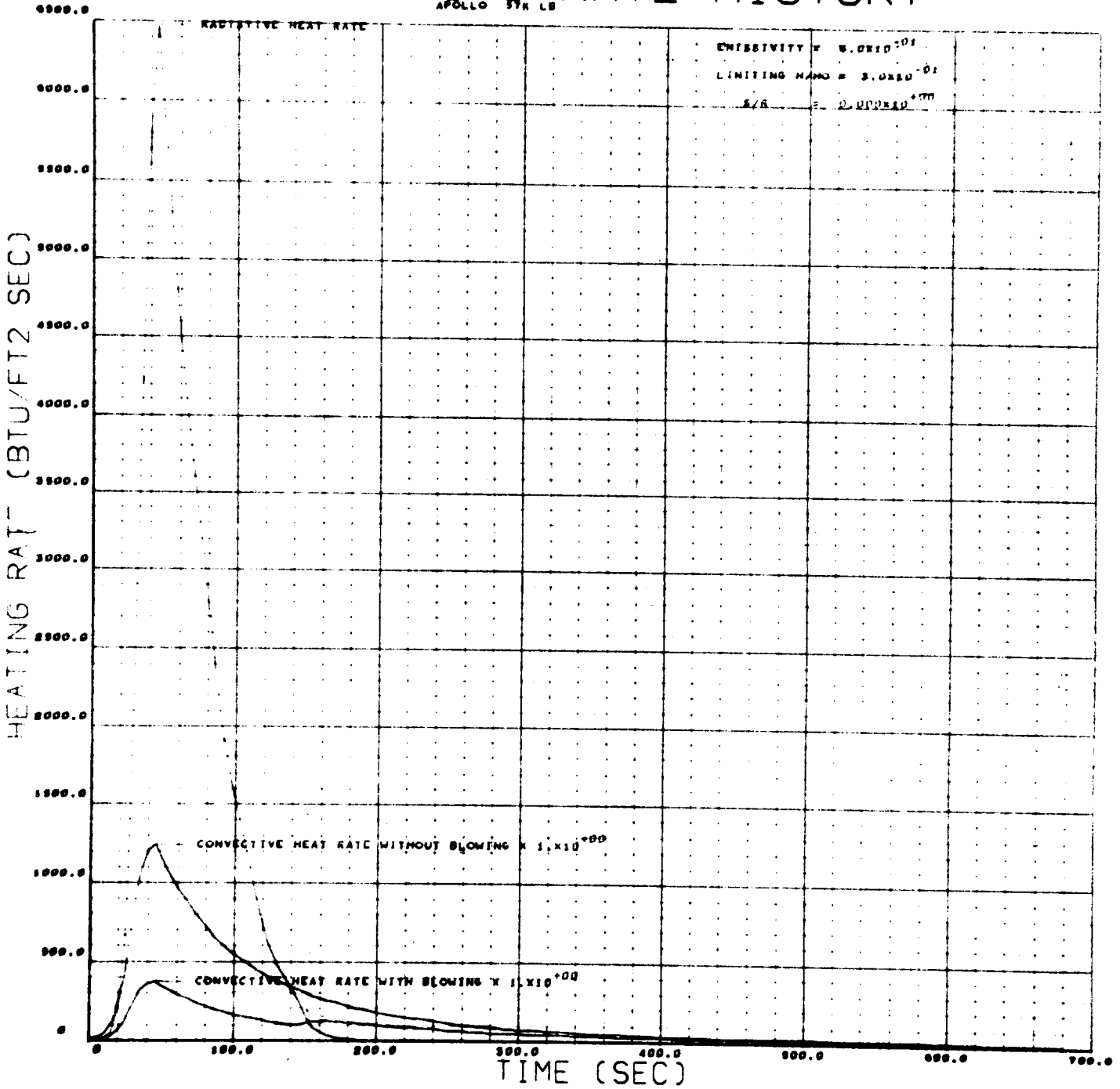


FIGURE A 28

MATERIAL RESPONSE DATA

APOLLO 37K LB

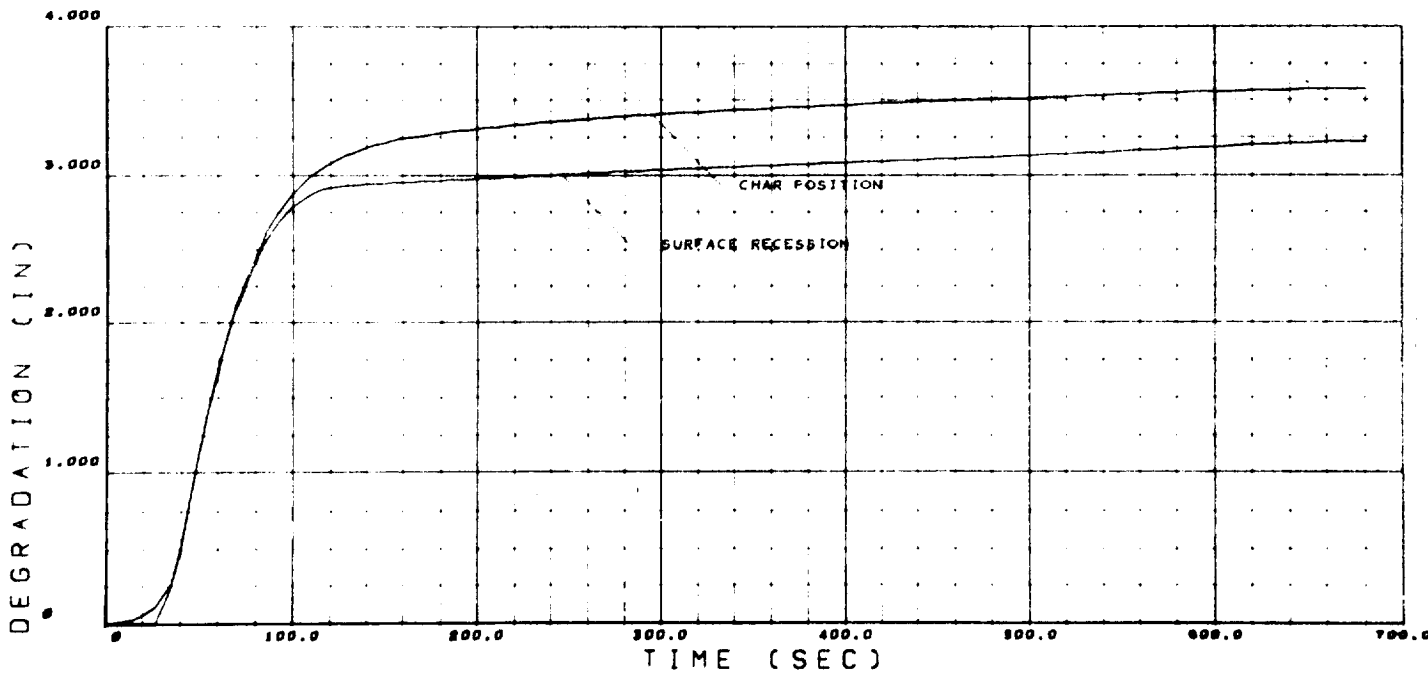
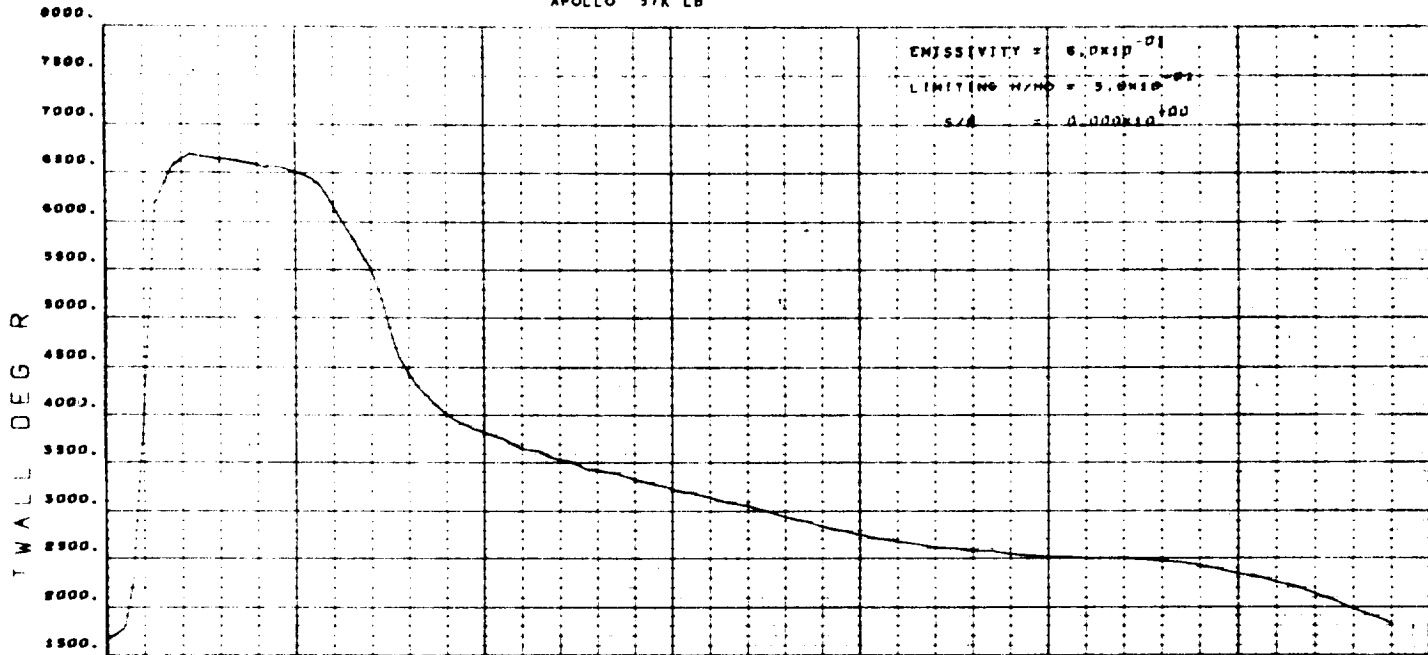
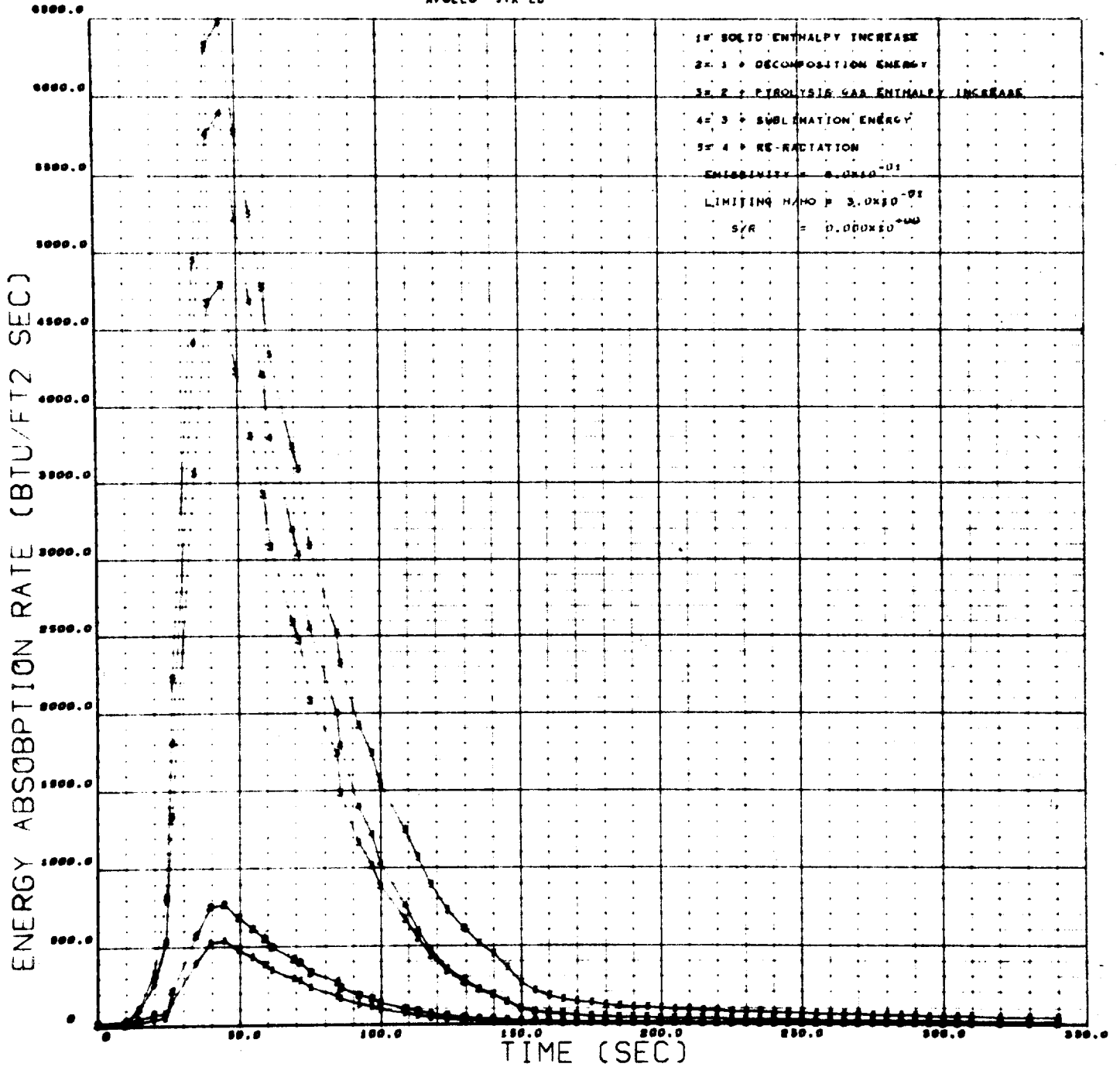


FIGURE A 28

ENERGY ACCOMMODATION MECHANISMS

APOLLO 37K LB



84

FIGURE A 29

HEATING RATE HISTORY

APOLLO 37K LD

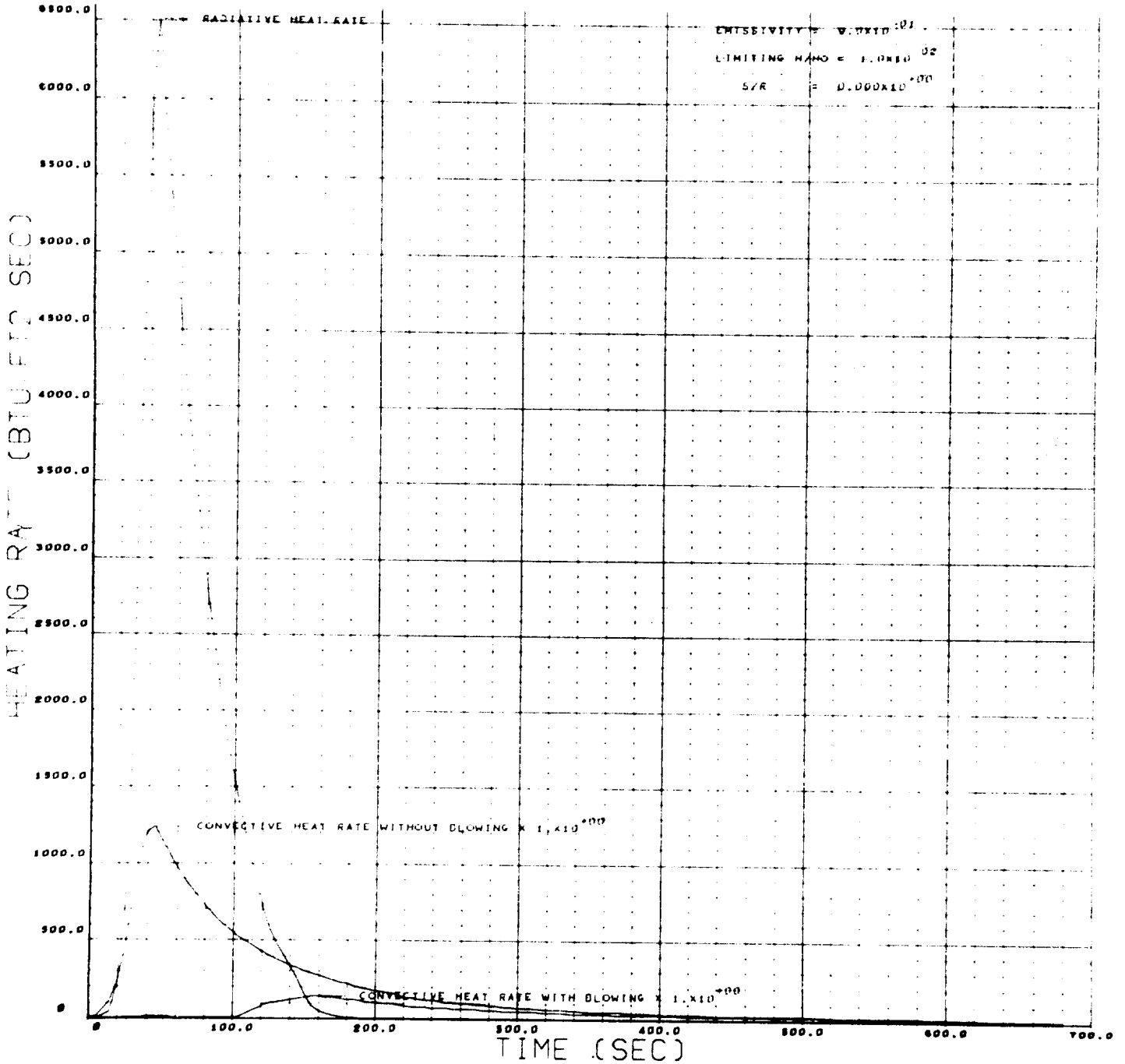


FIGURE A 29

MATERIAL RESPONSE DATA

APOLLO 57K LB

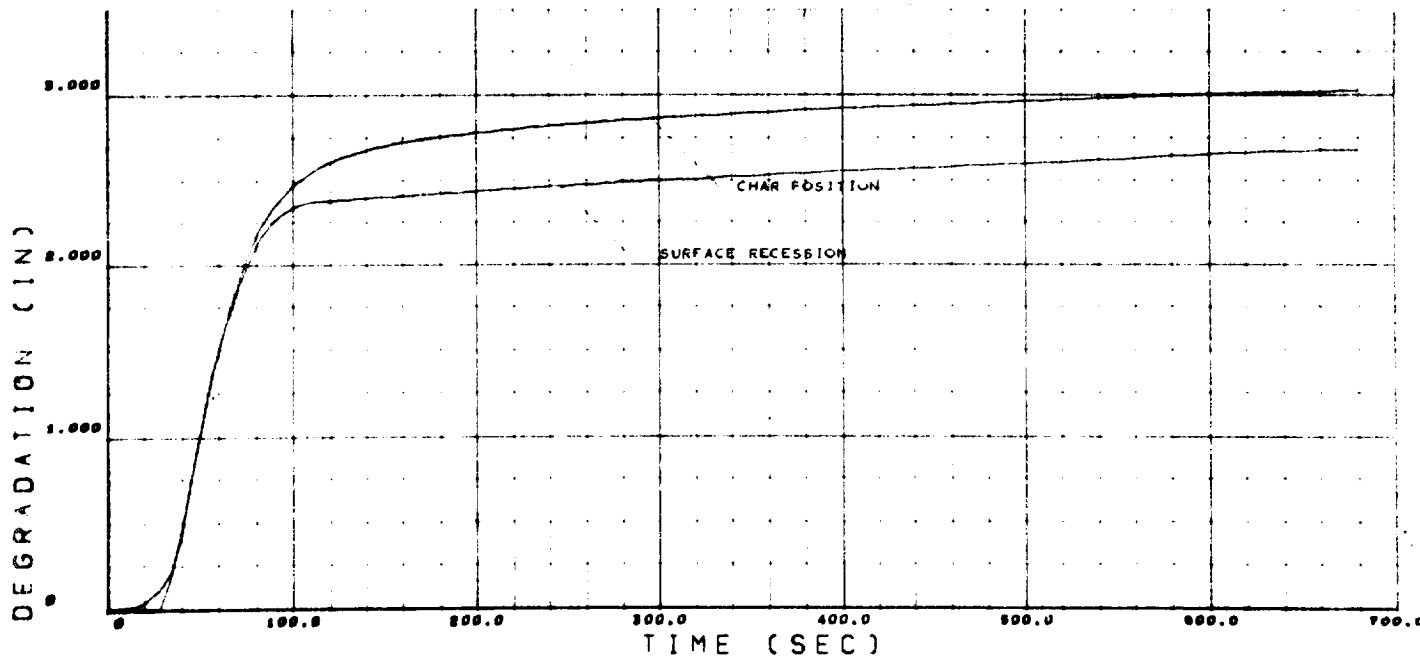
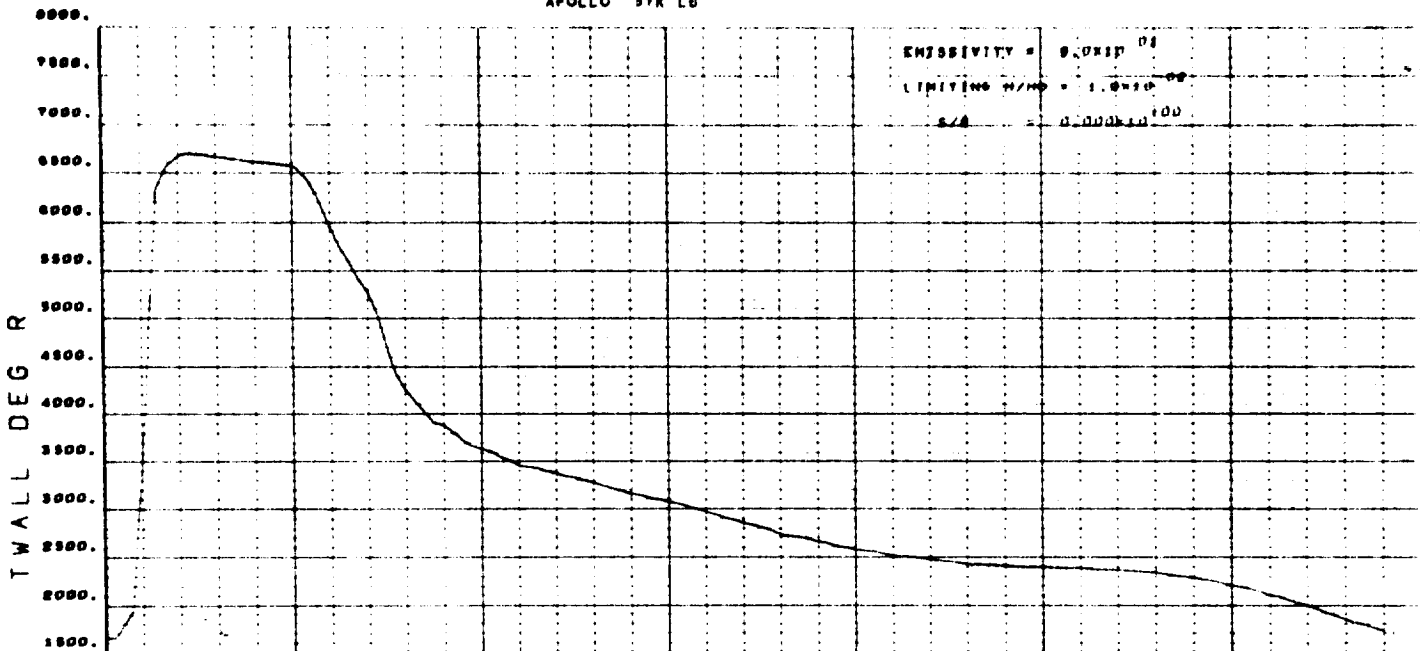


FIGURE A29

ENERGY ACCOMMODATION MECHANISMS

APOLLO 37K LB

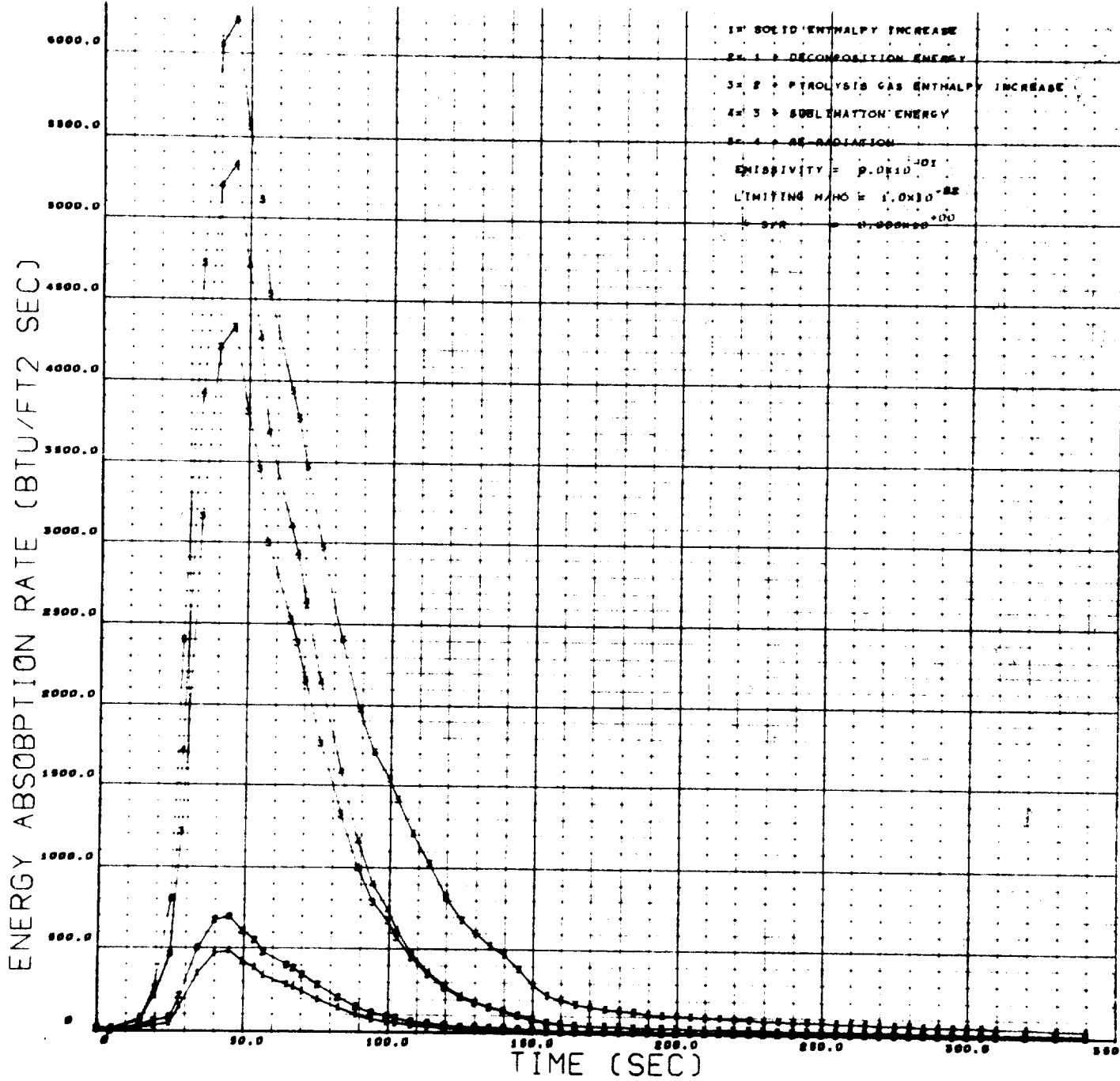


FIGURE A30

HEATING RATE HISTORY

APOLLO 17K LB

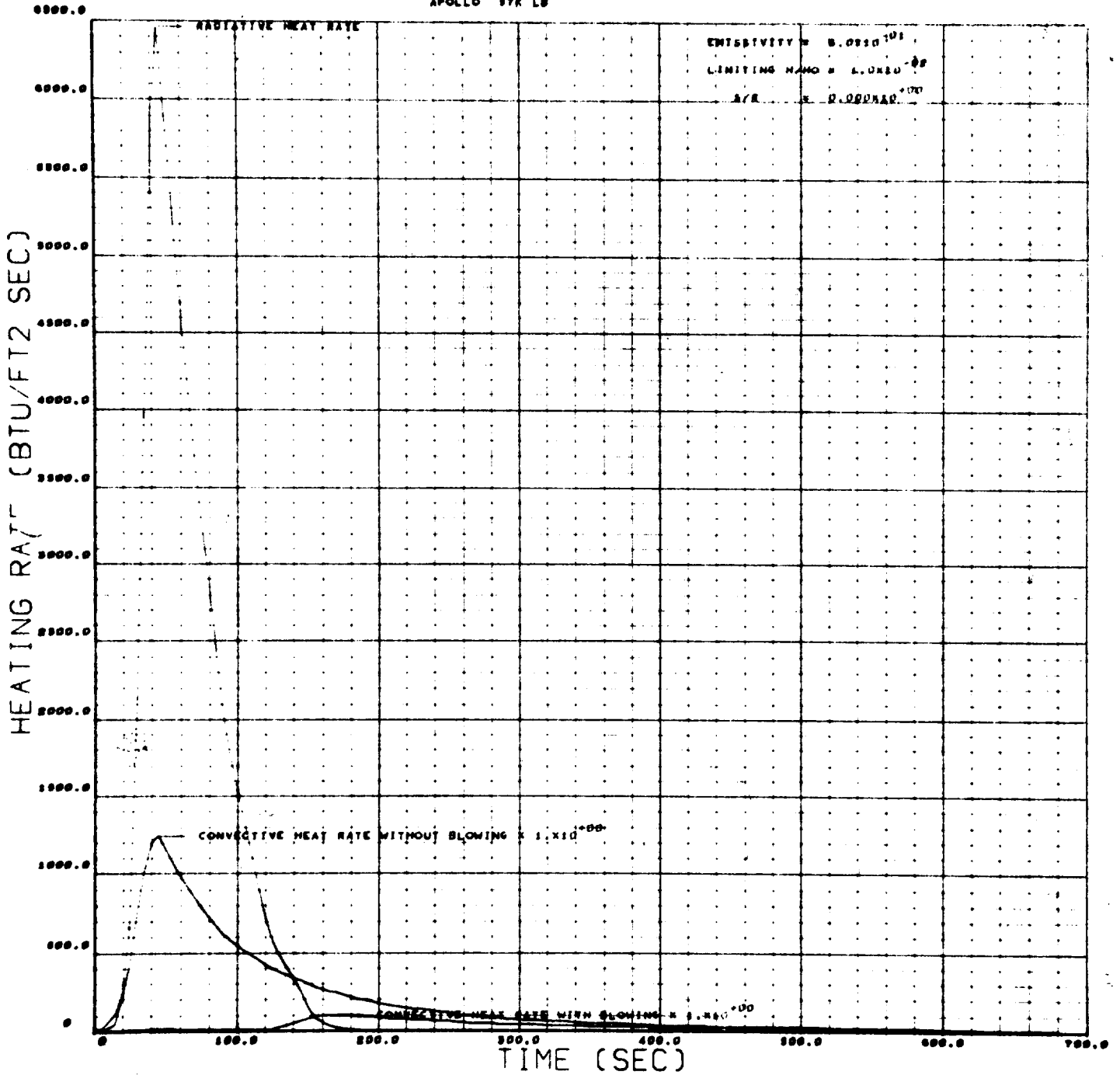


FIGURE A30

MATERIAL RESPONSE DATA

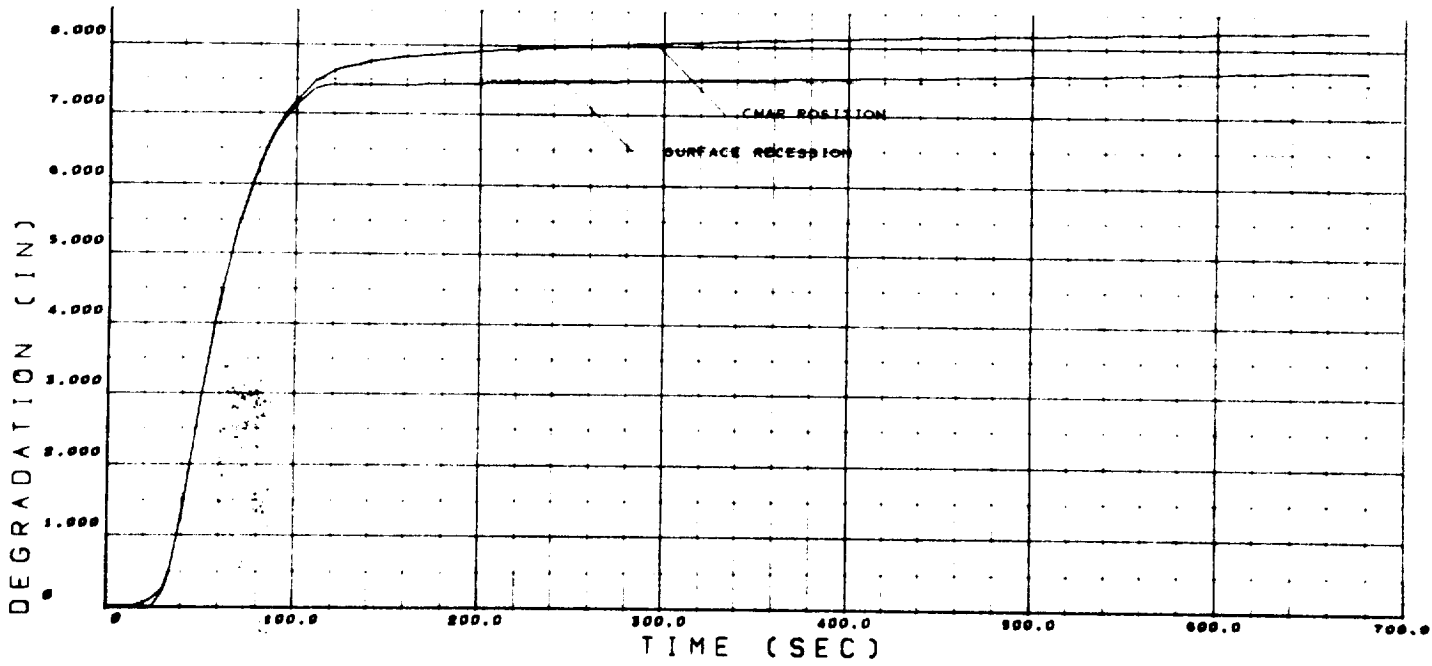
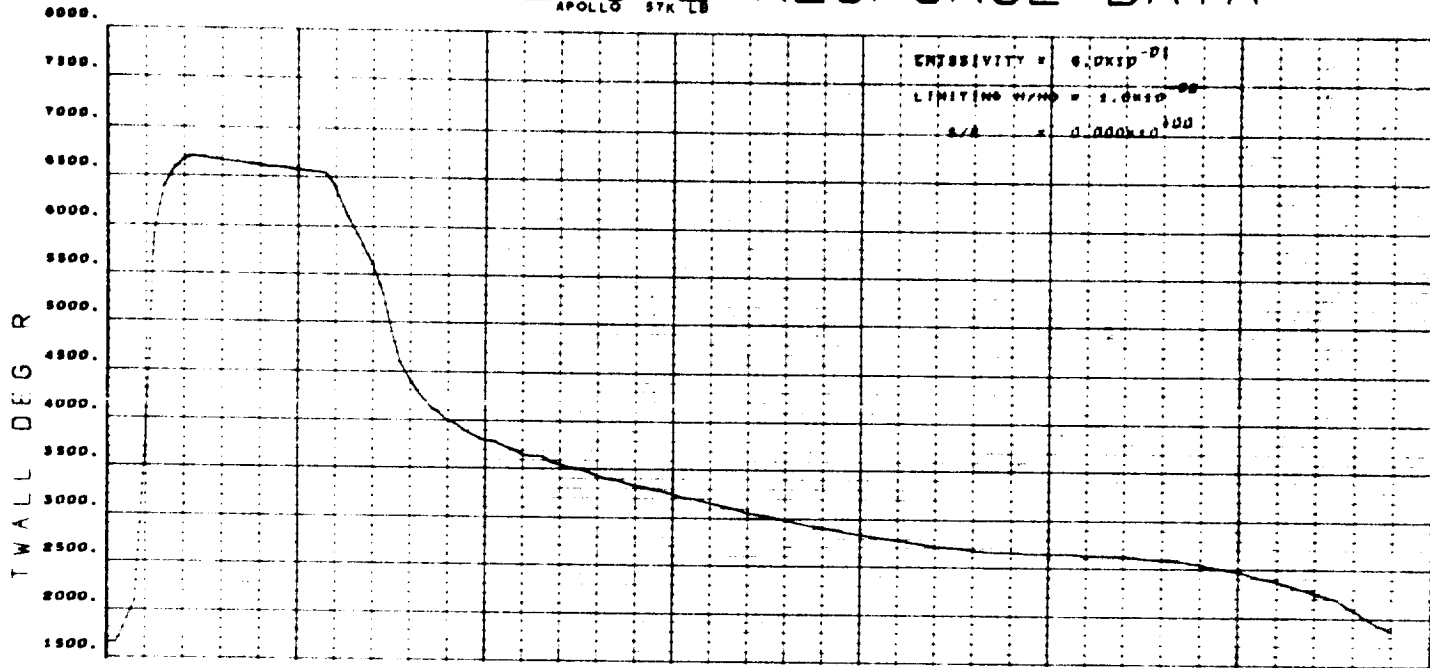


FIGURE A 30

ENERGY ACCOMMODATION MECHANISMS

APOLLO 57K LB

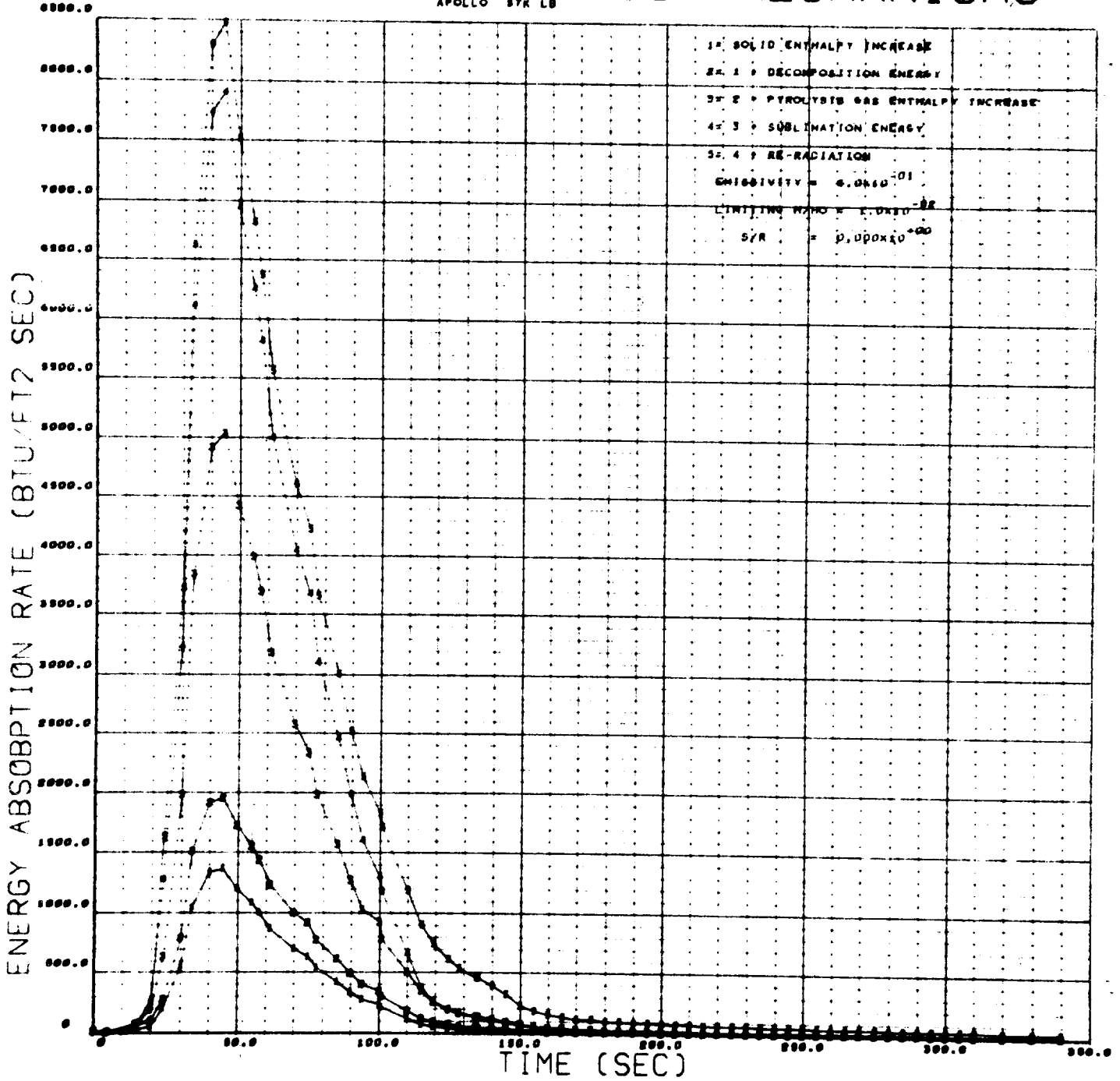


FIGURE A31

HEATING RATE HISTORY

APOLLO 17X LB

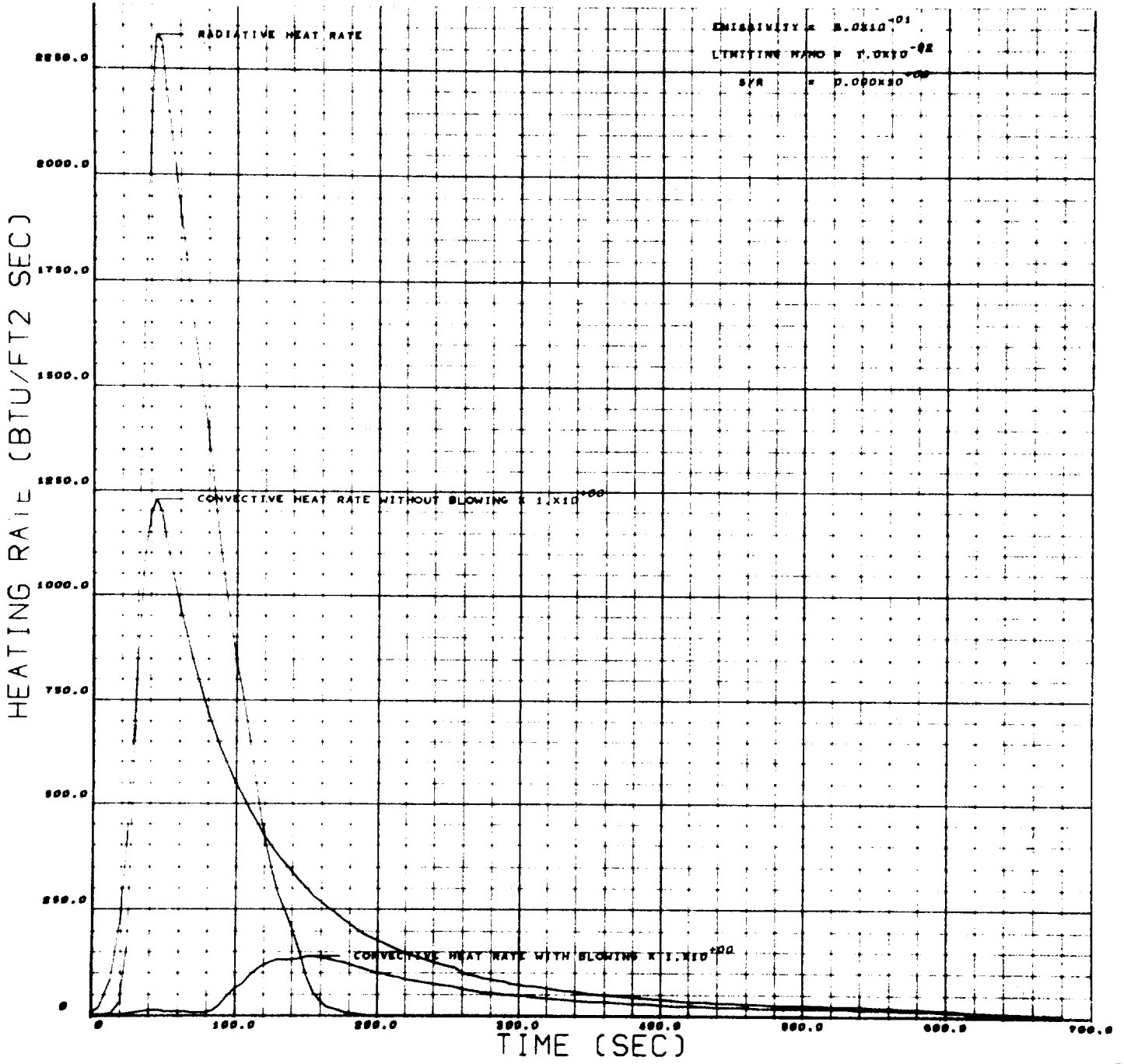


FIGURE A31

MATERIAL RESPONSE DATA

APOLLO 87X LB

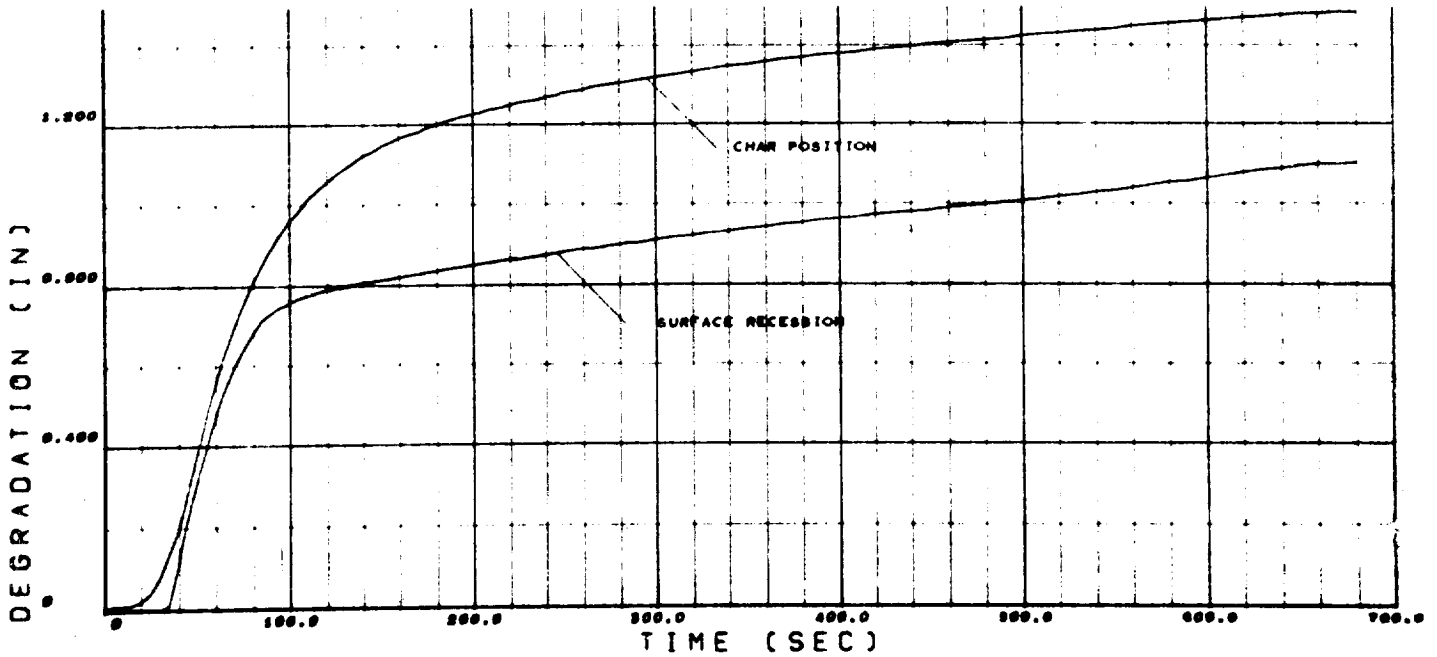
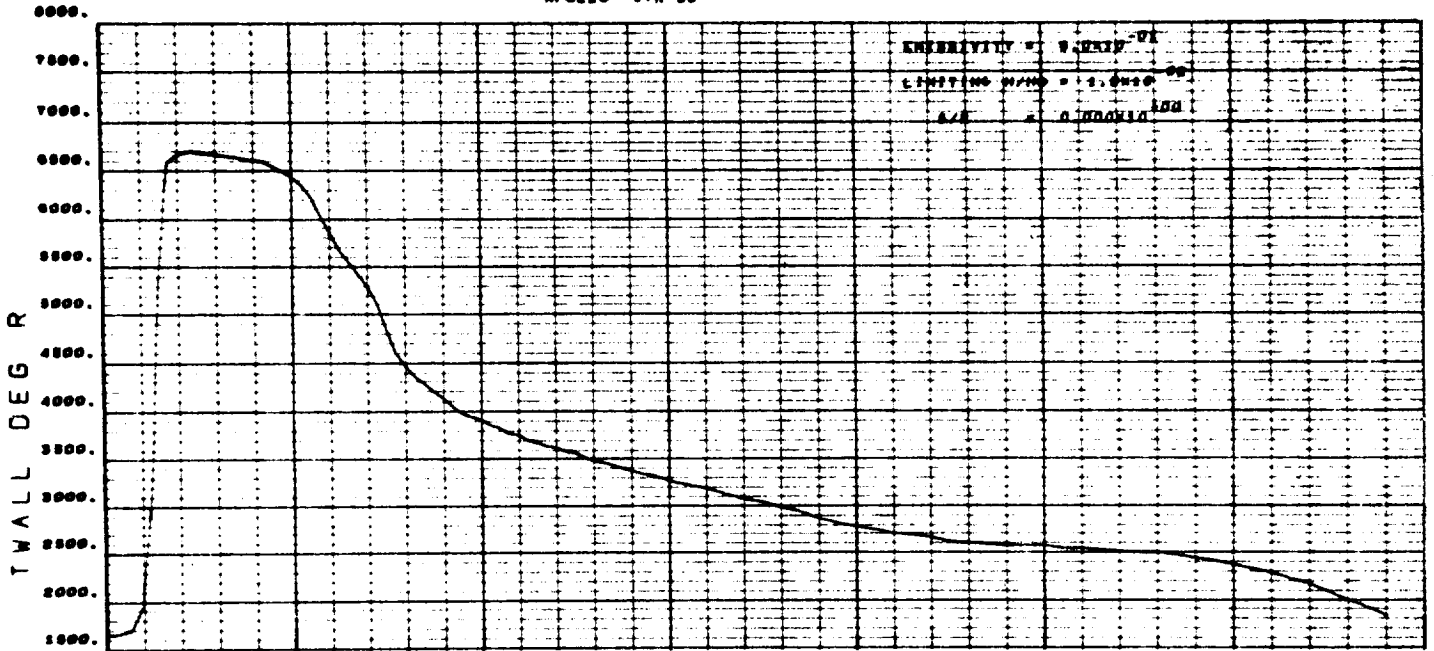


FIGURE A31

ENERGY ACCOMMODATION MECHANISMS

APOLLO 17K LB

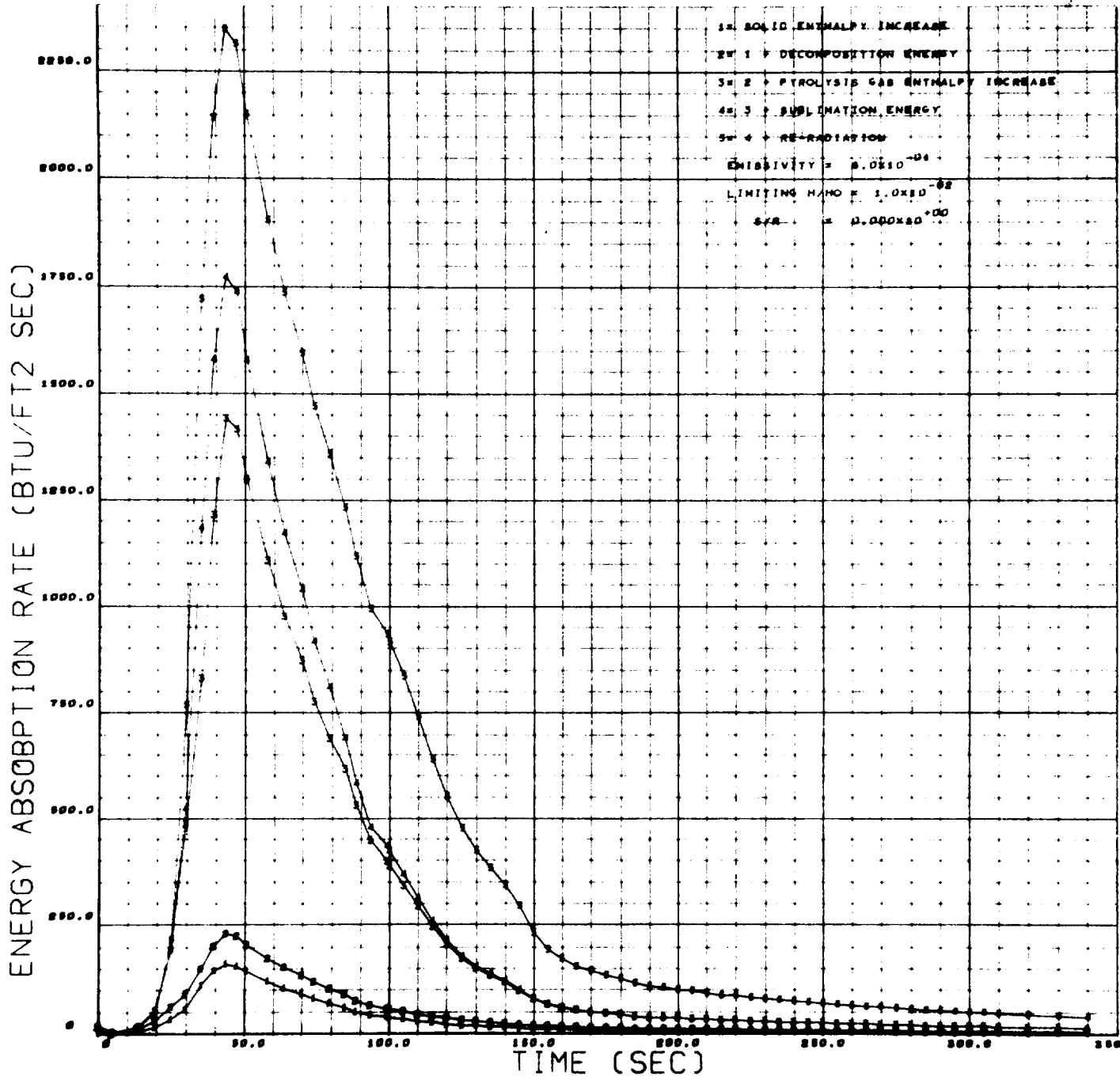


FIGURE A32

HEATING RATE HISTORY

APOLLO 37K LB

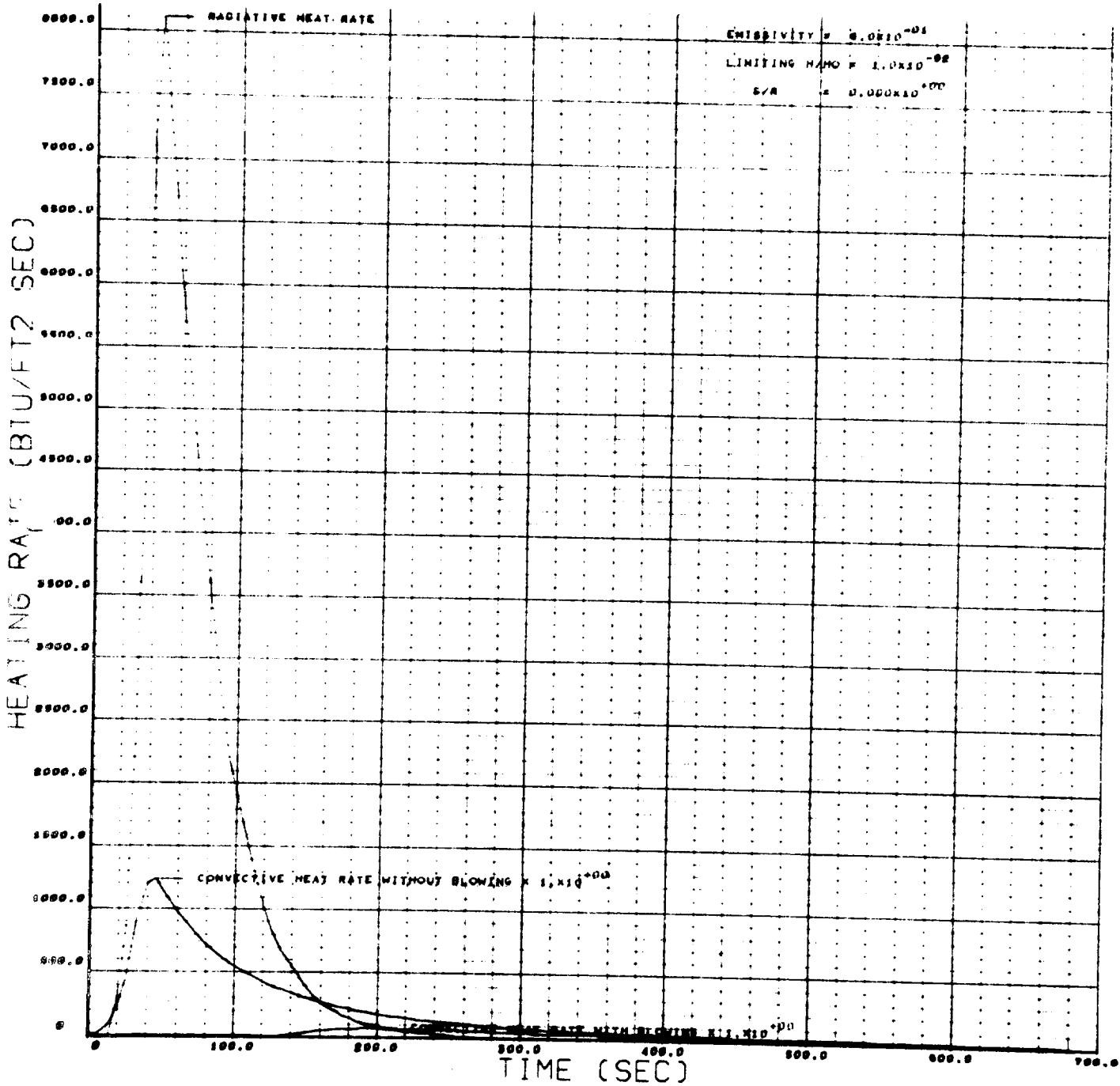


FIGURE A32

MATERIAL RESPONSE DATA

APOLLO 37K LB

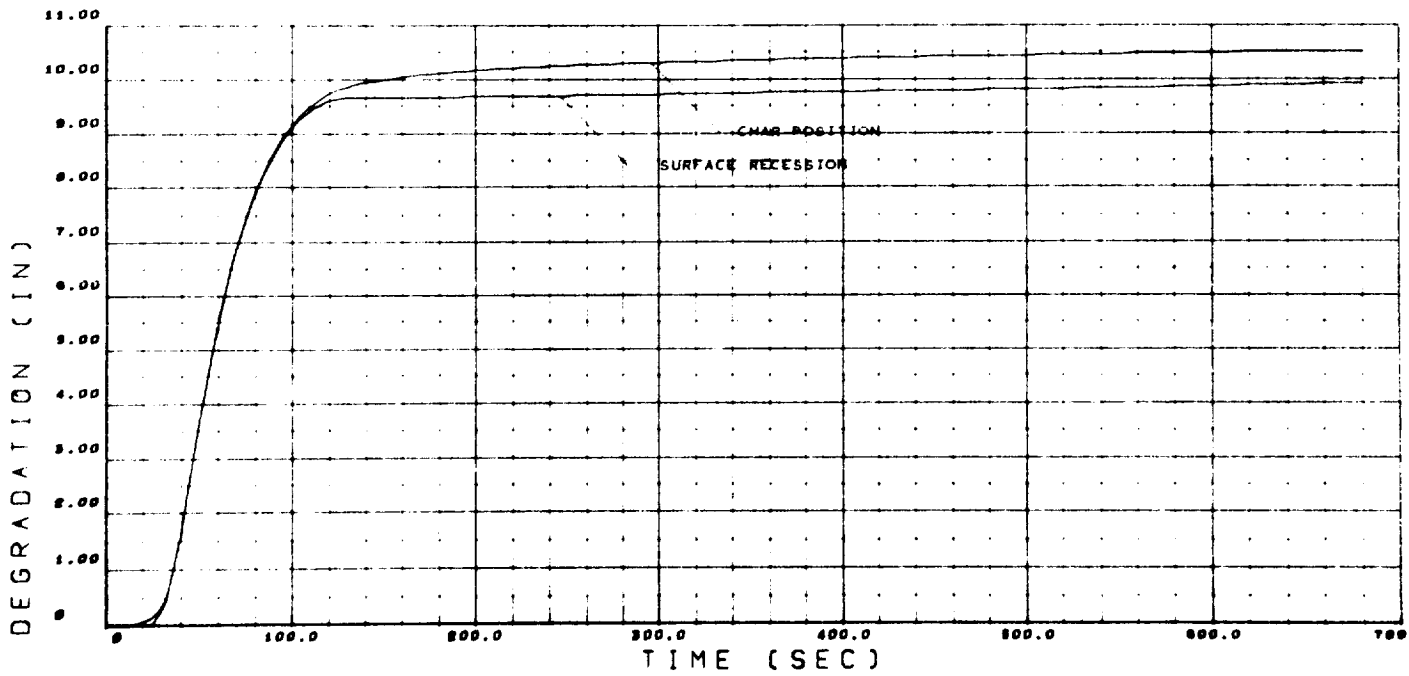
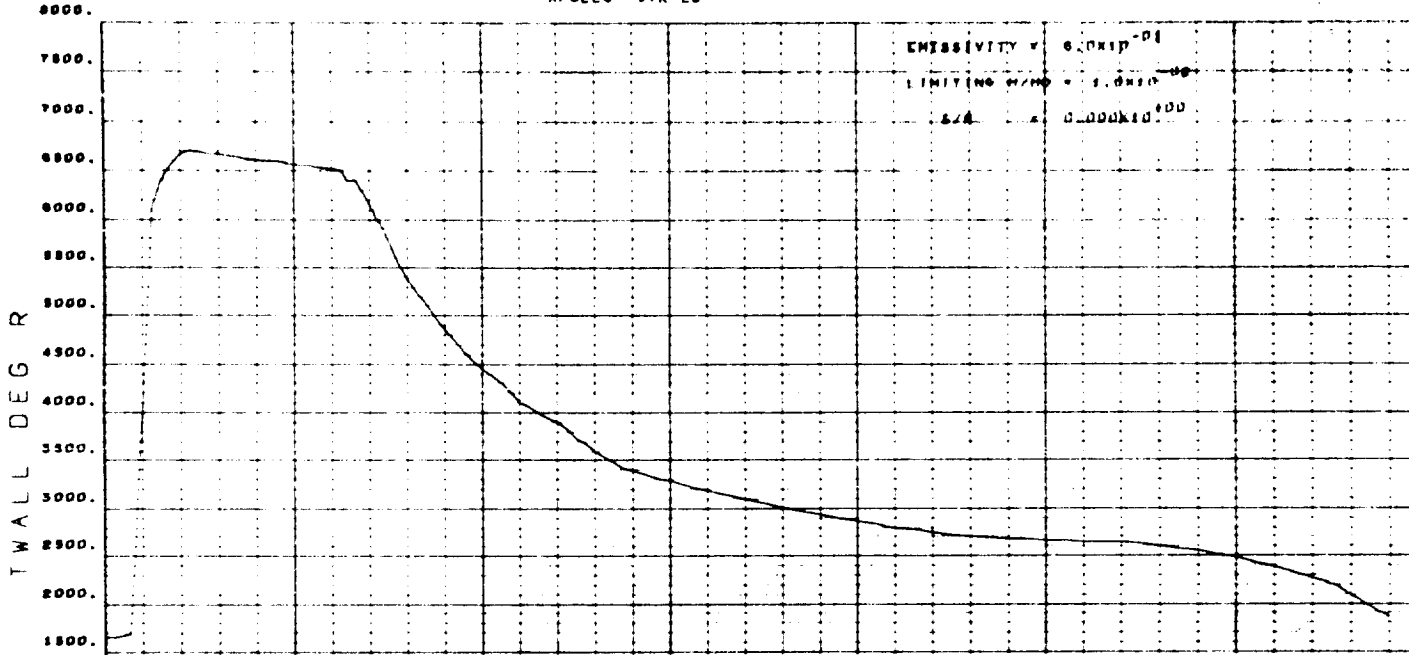


FIGURE A32

ENERGY ACCOMMODATION MECHANISMS

APOLLO 17K LB

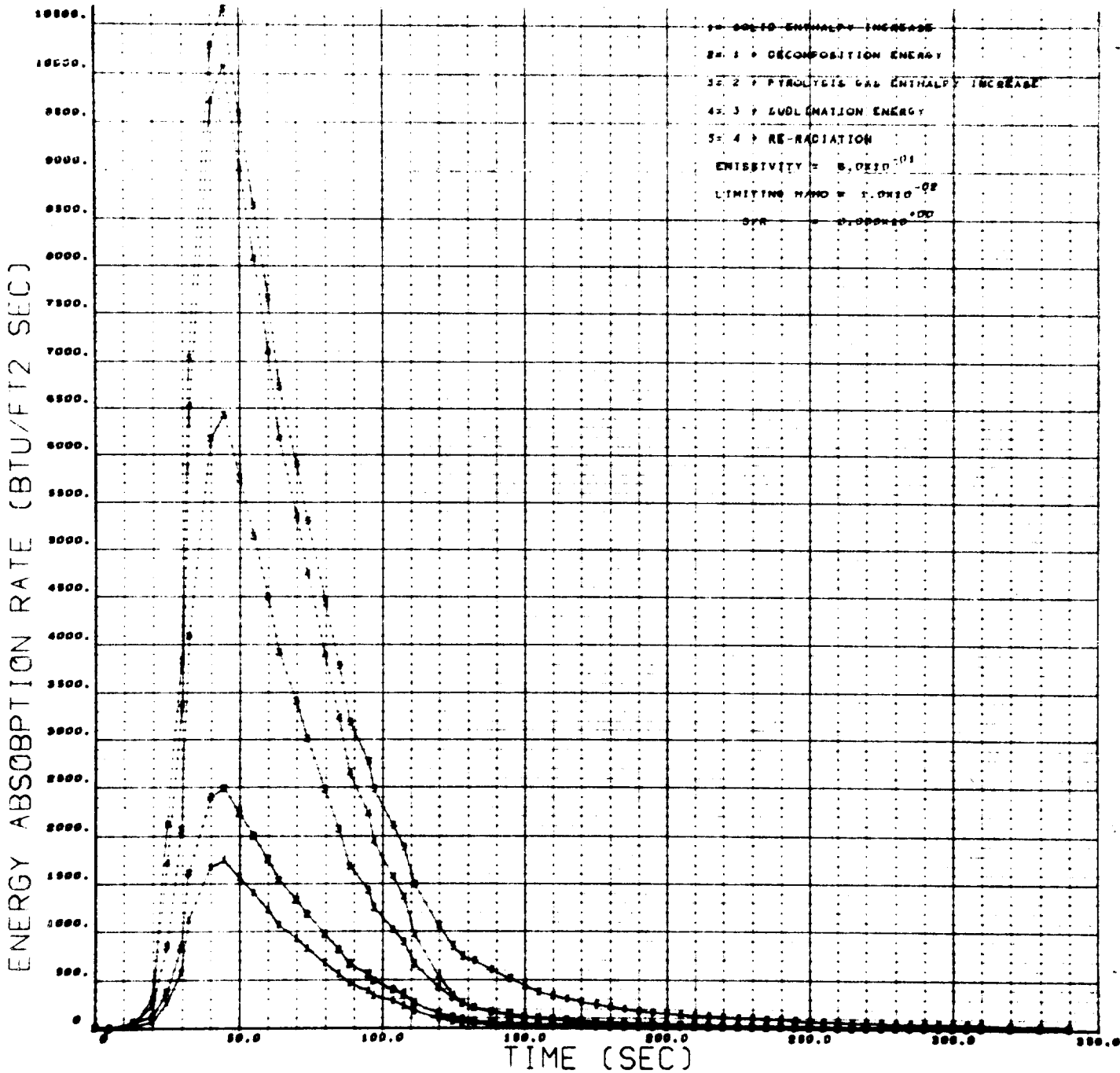


FIGURE A33

HEATING RATE HISTORY

APOLLO 37K LB

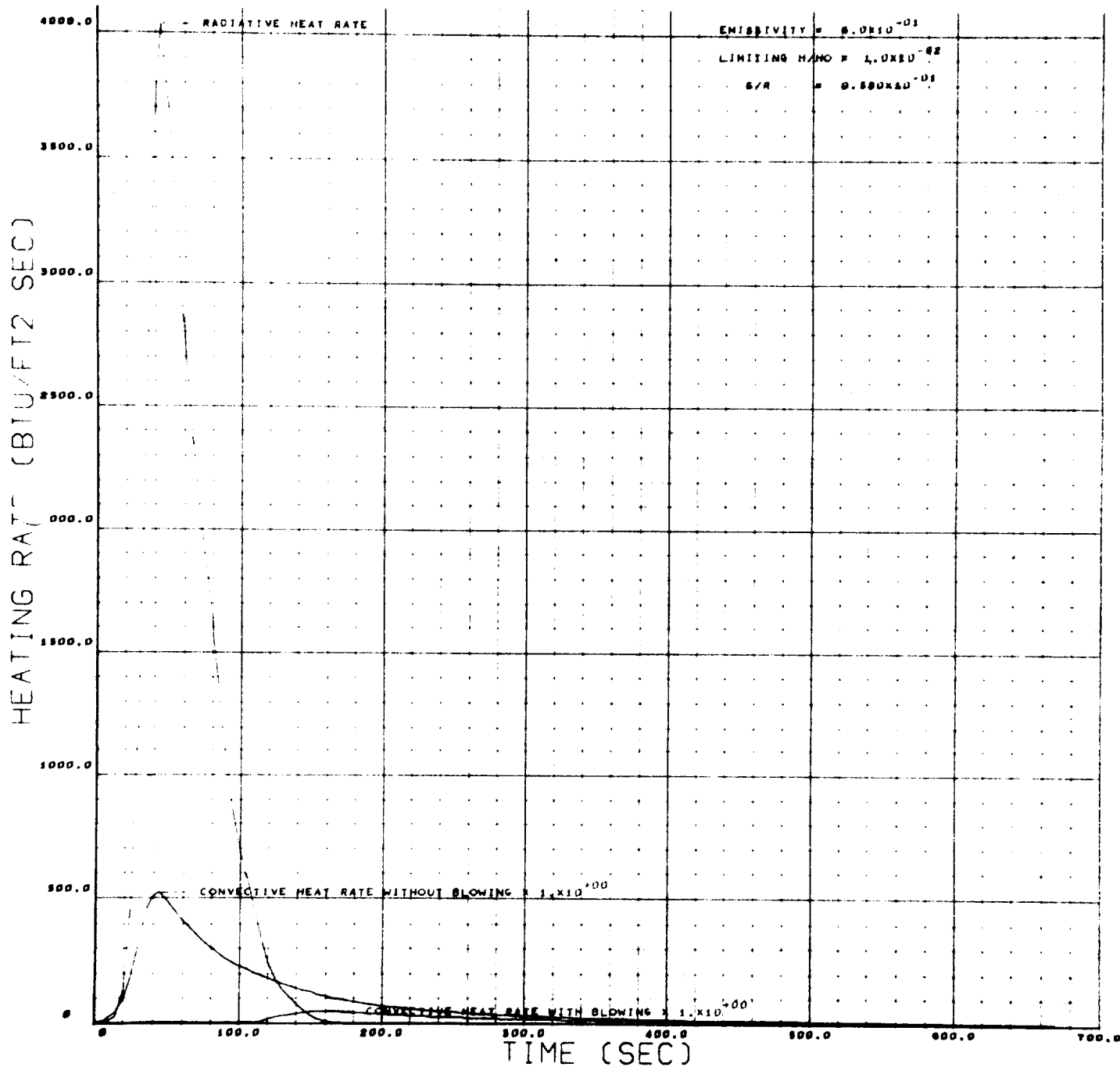


FIGURE A33

MATERIAL RESPONSE DATA

APOLLO 37X LB

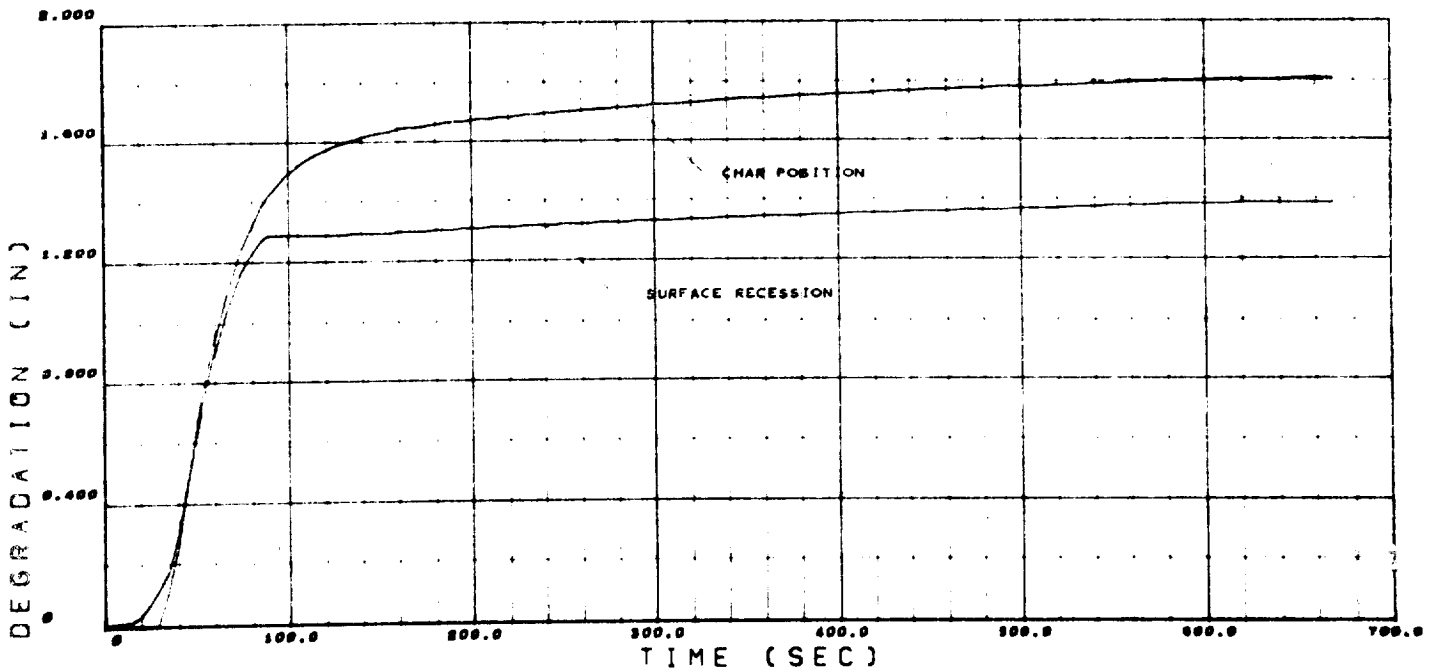
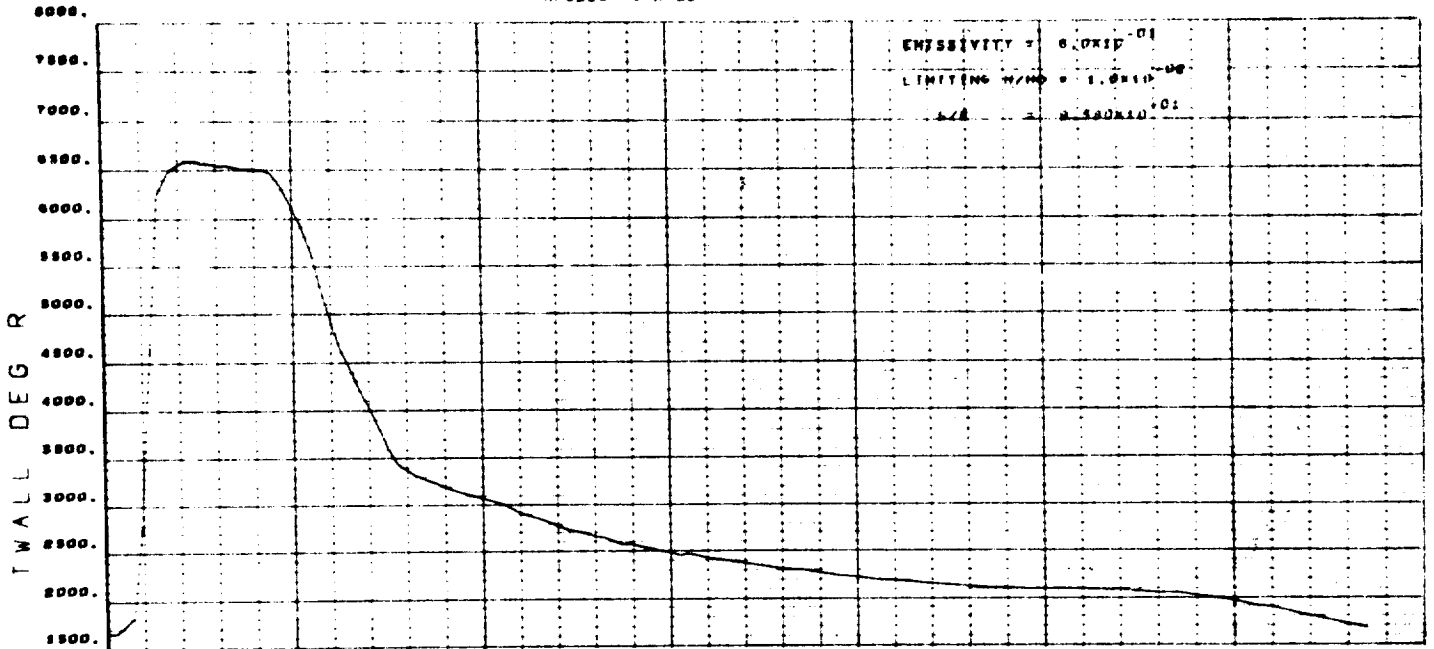


FIGURE A33

ENERGY ACCOMMODATION MECHANISMS

APOLLO 37K LB

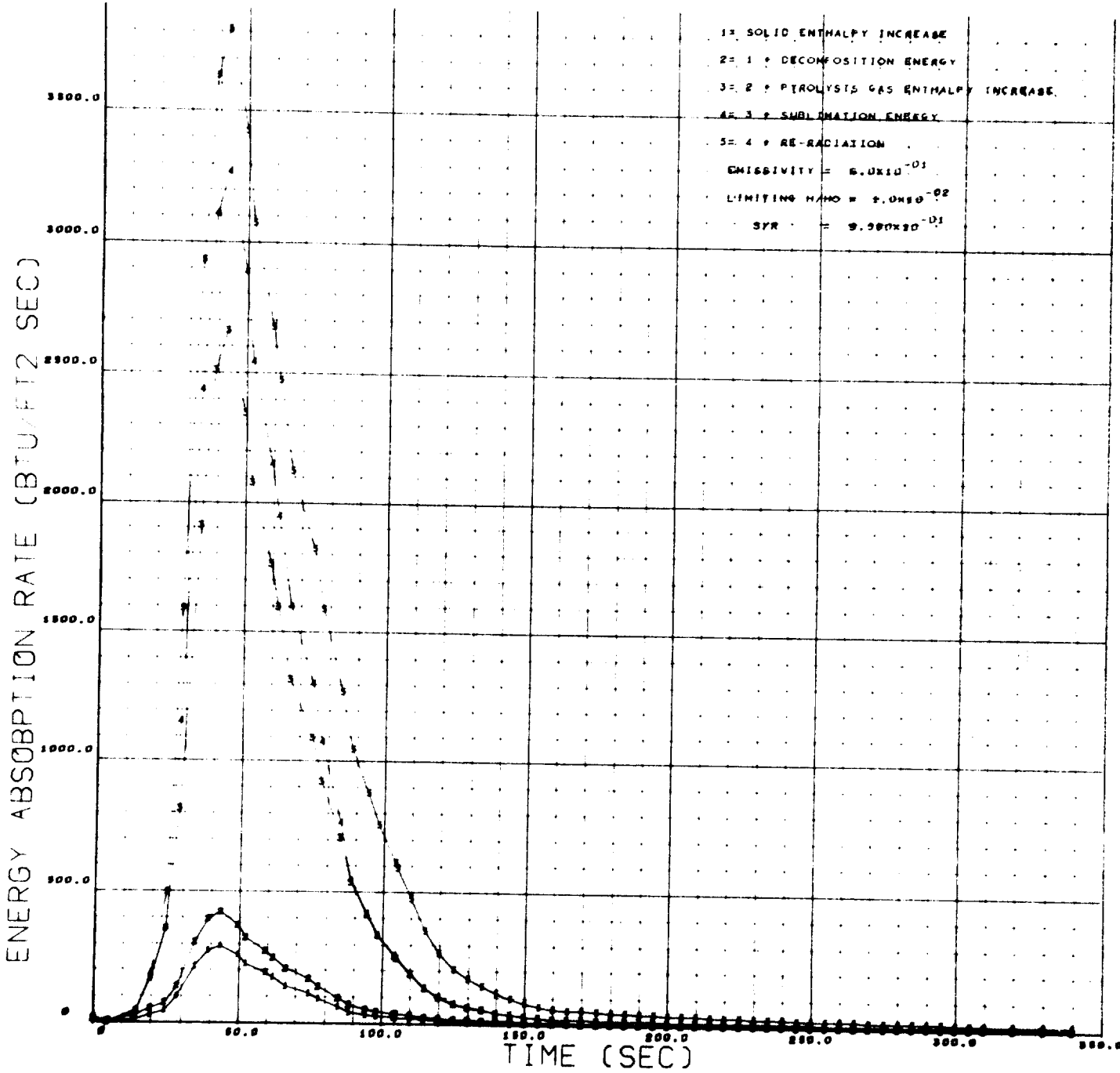


FIGURE A34

HEATING RATE HISTORY

APOLLO 57K LB

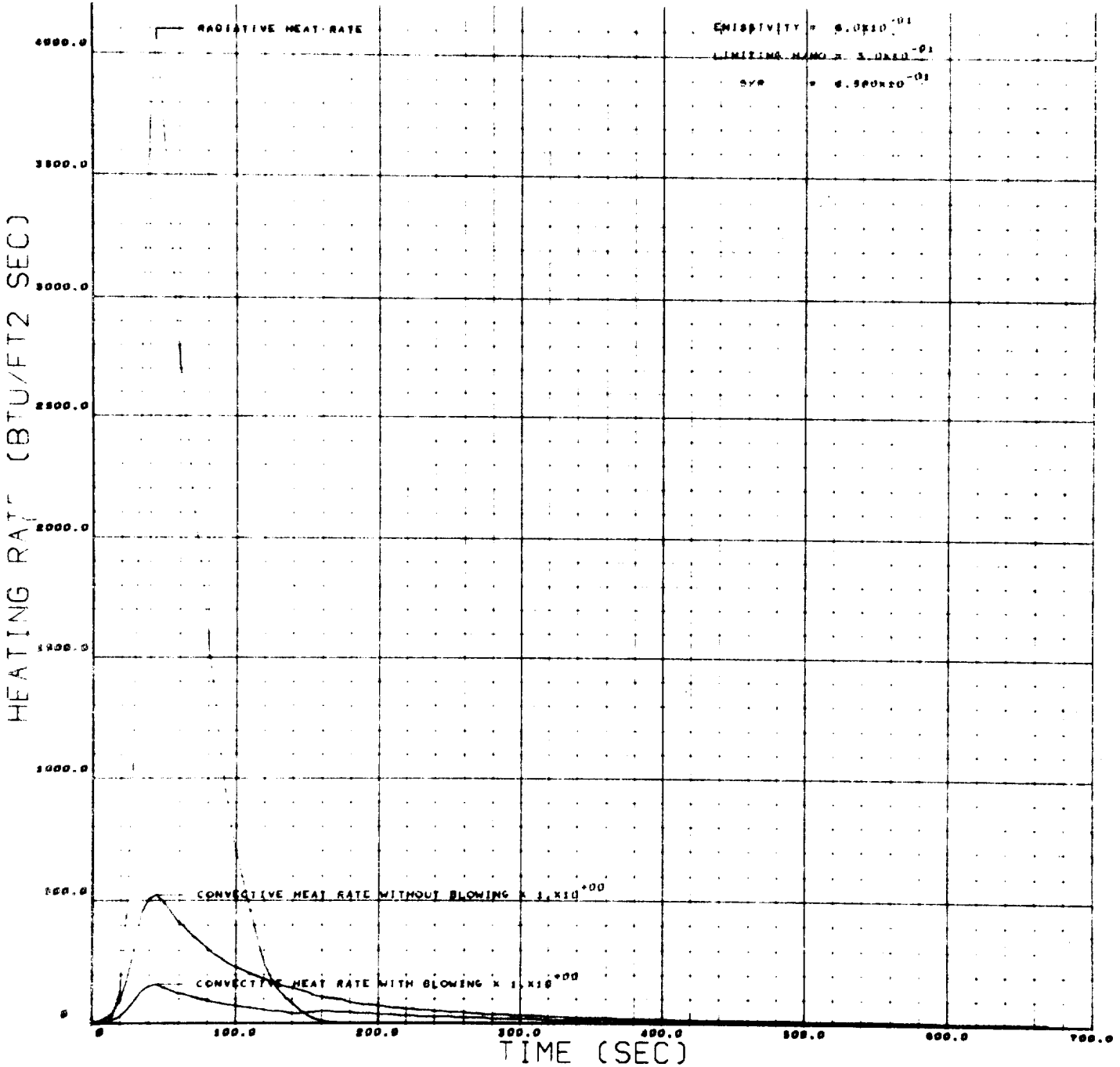


FIGURE A34

MATERIAL RESPONSE DATA

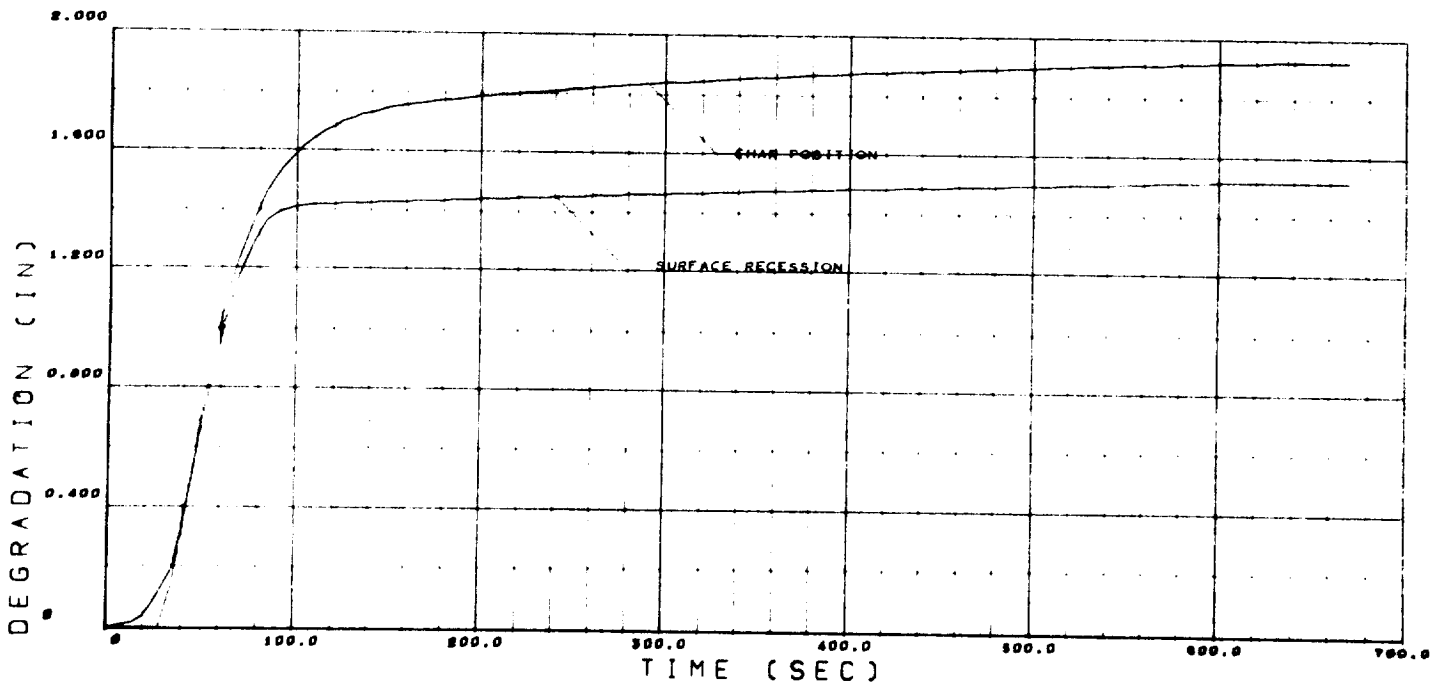
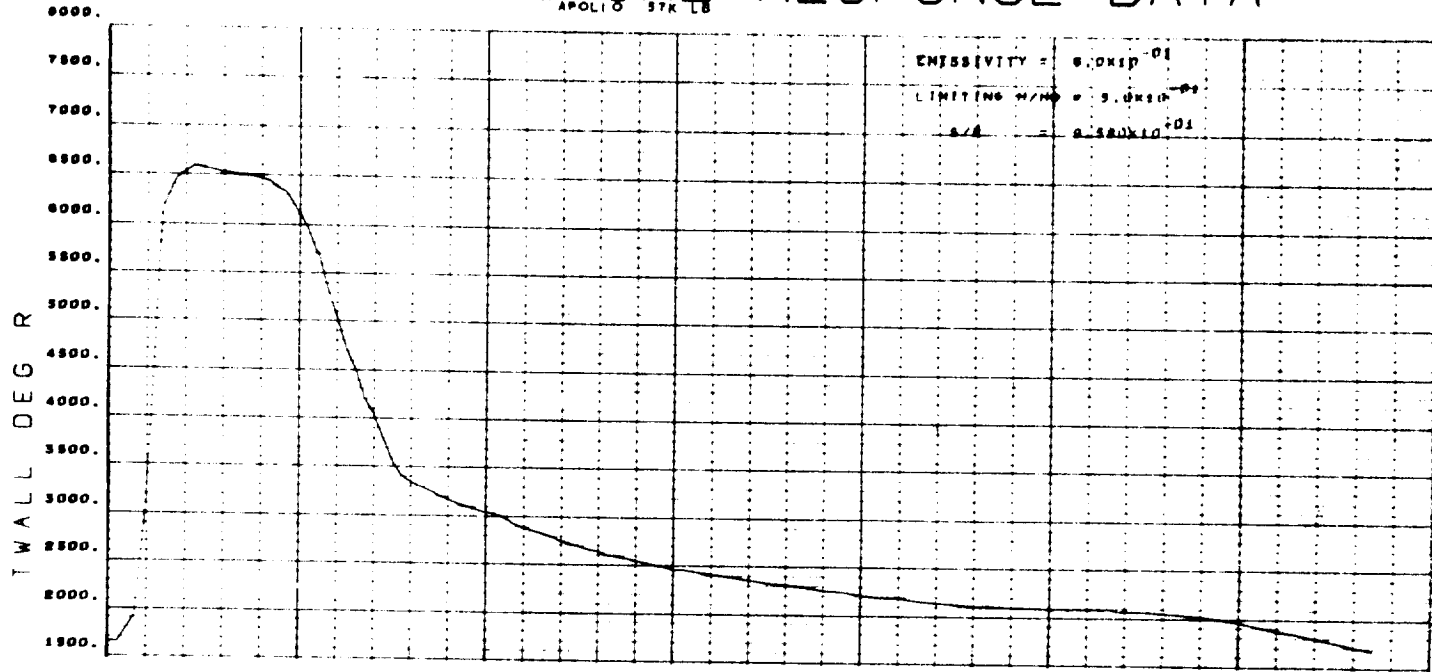


FIGURE A34

ENERGY ACCOMMODATION MECHANISMS

APOLLO 17K LB

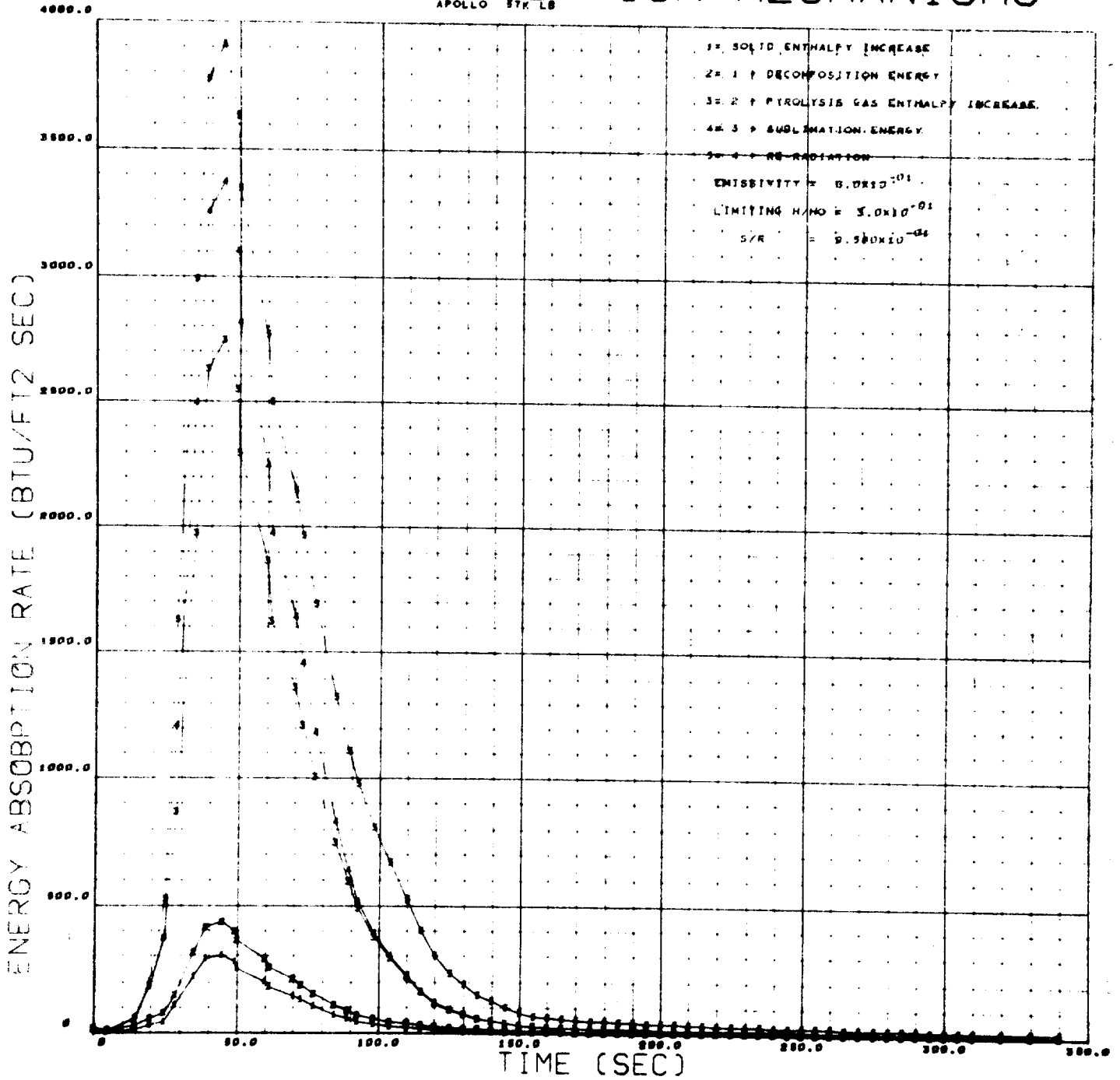


FIGURE A35

HEATING RATE HISTORY

APOLLO 37K LB

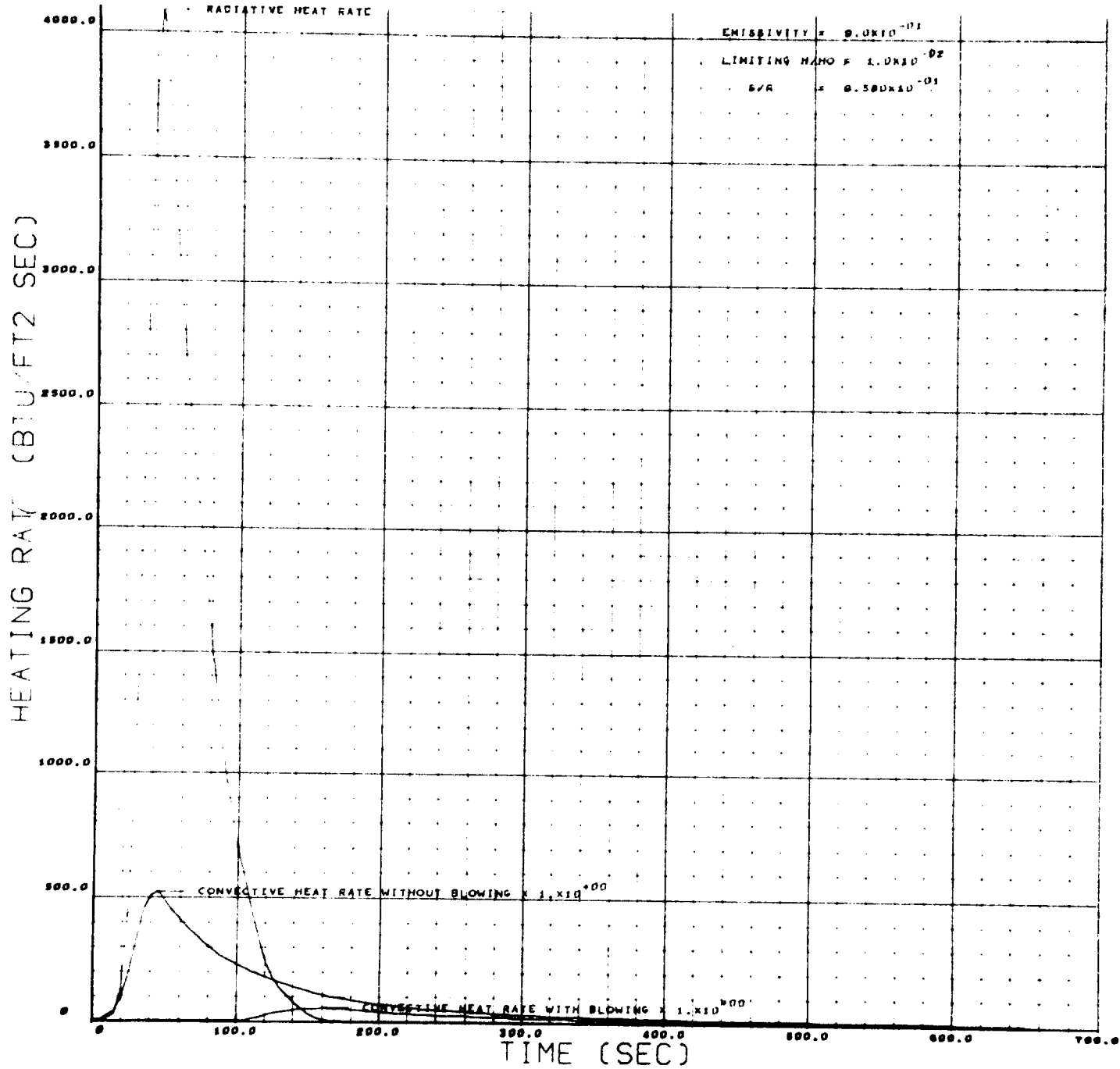


FIGURE A35

MATERIAL RESPONSE DATA

APOLLO 37K LB

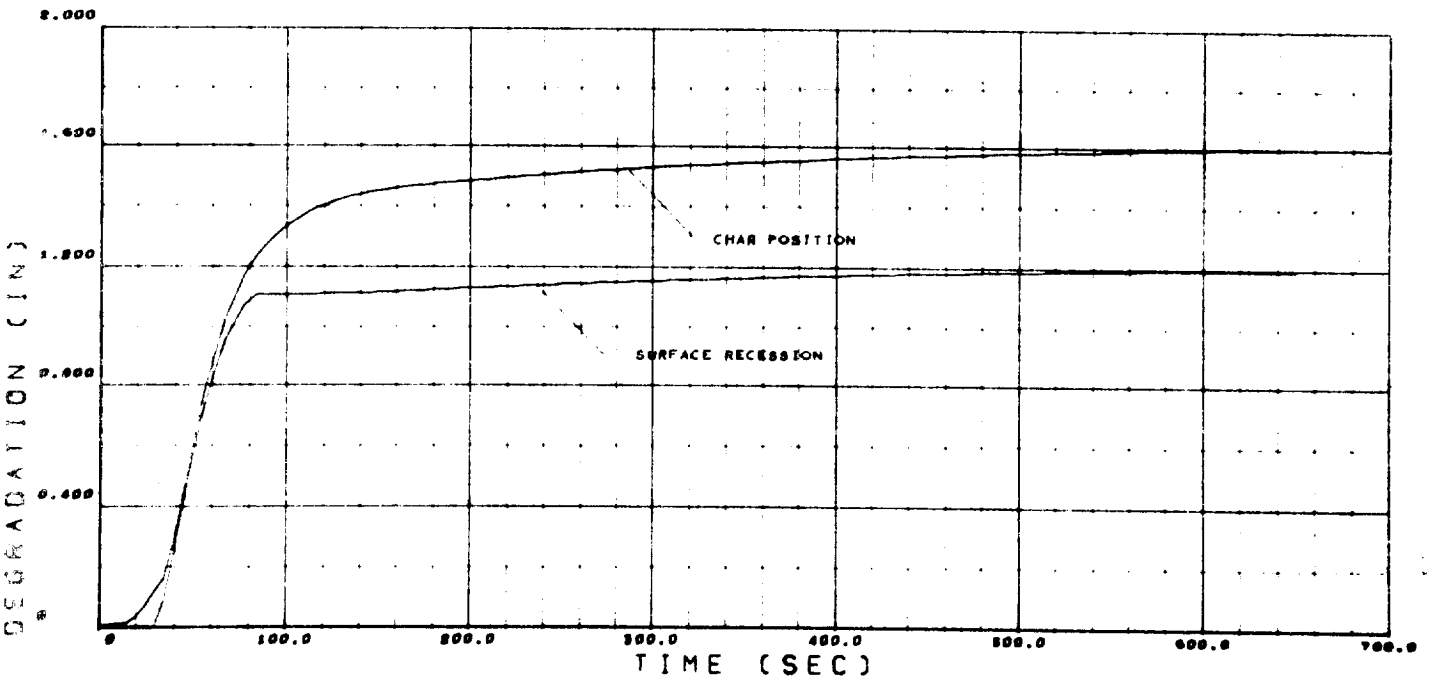
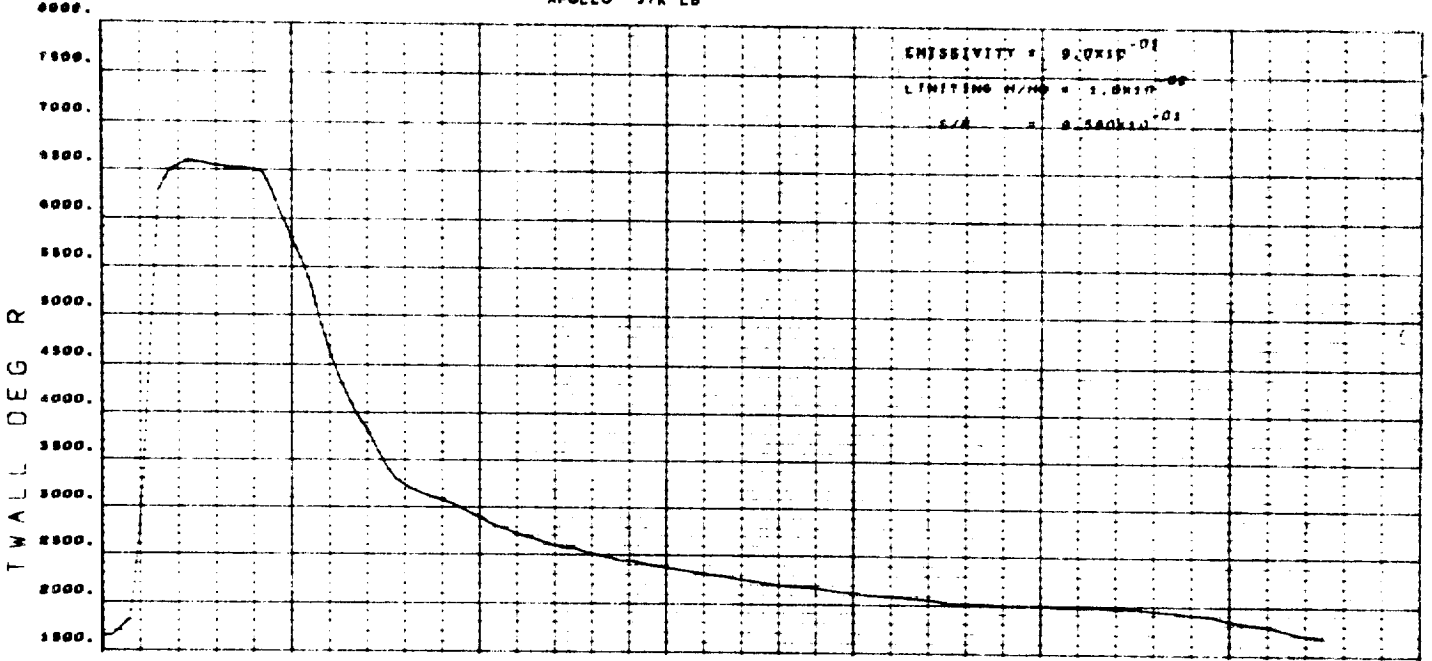


FIGURE A35

ENERGY ACCOMMODATION MECHANISMS

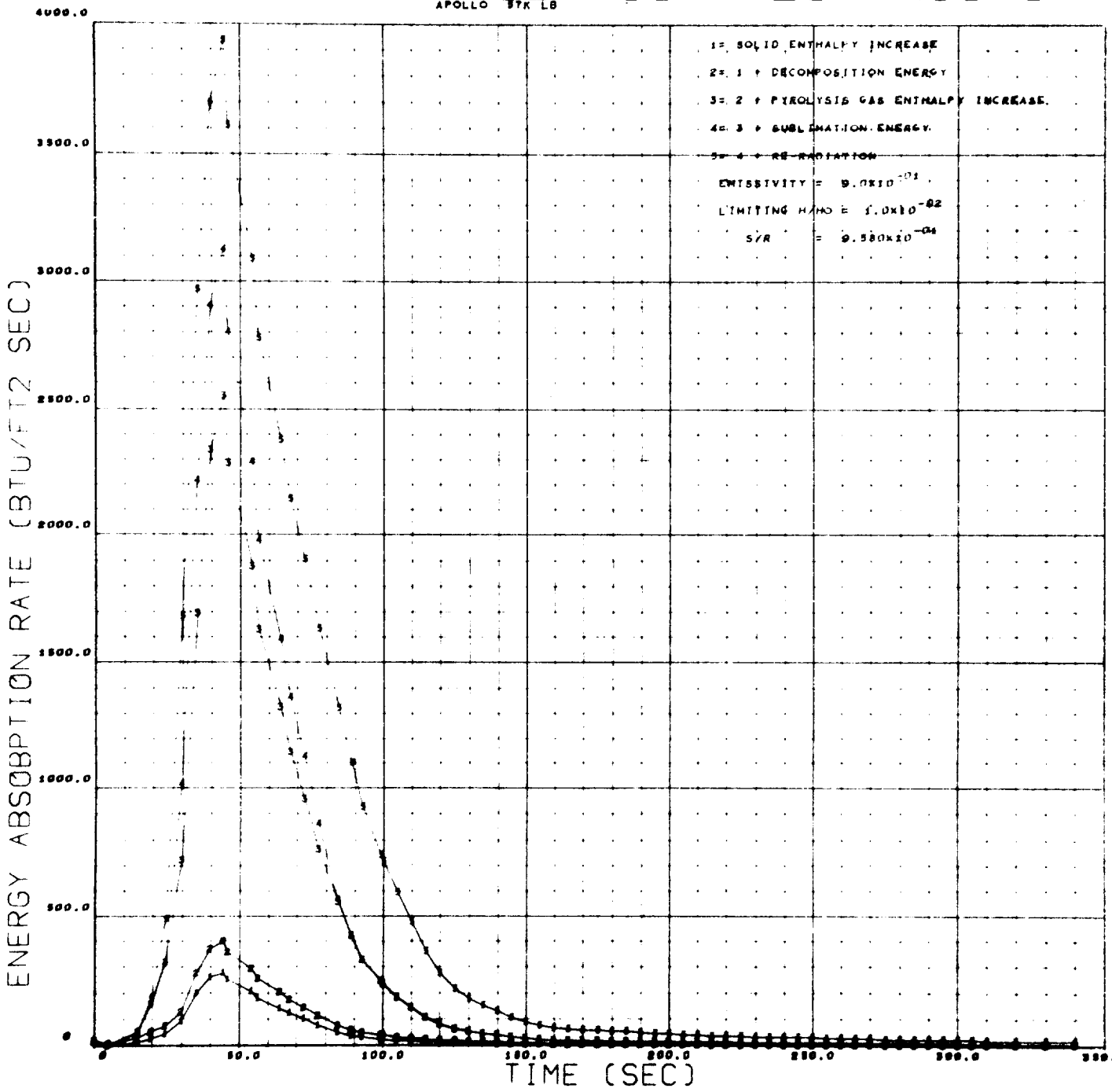


FIGURE A36

HEATING RATE HISTORY

APOLLO 37K LB

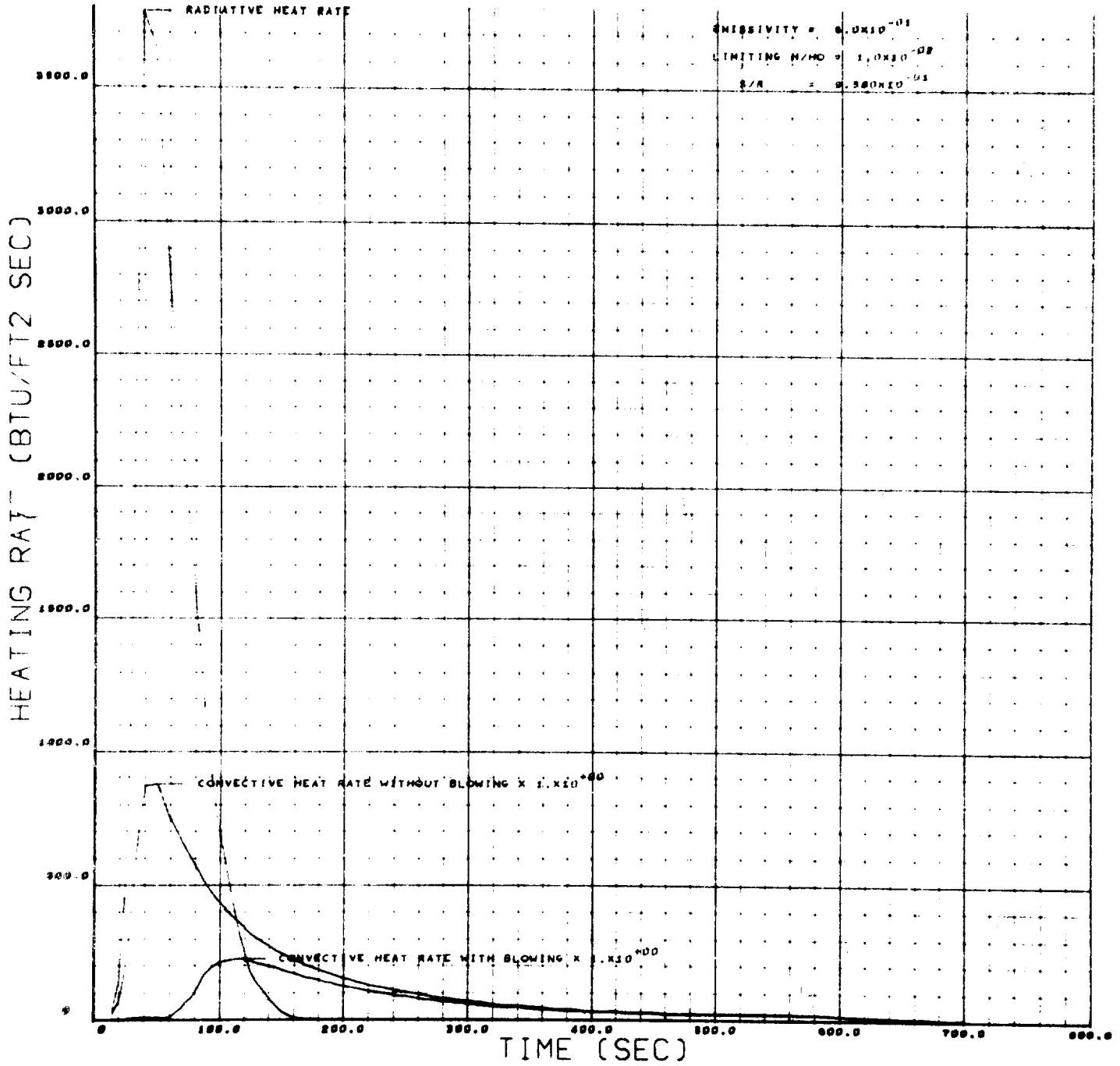


FIGURE A36

MATERIAL RESPONSE DATA

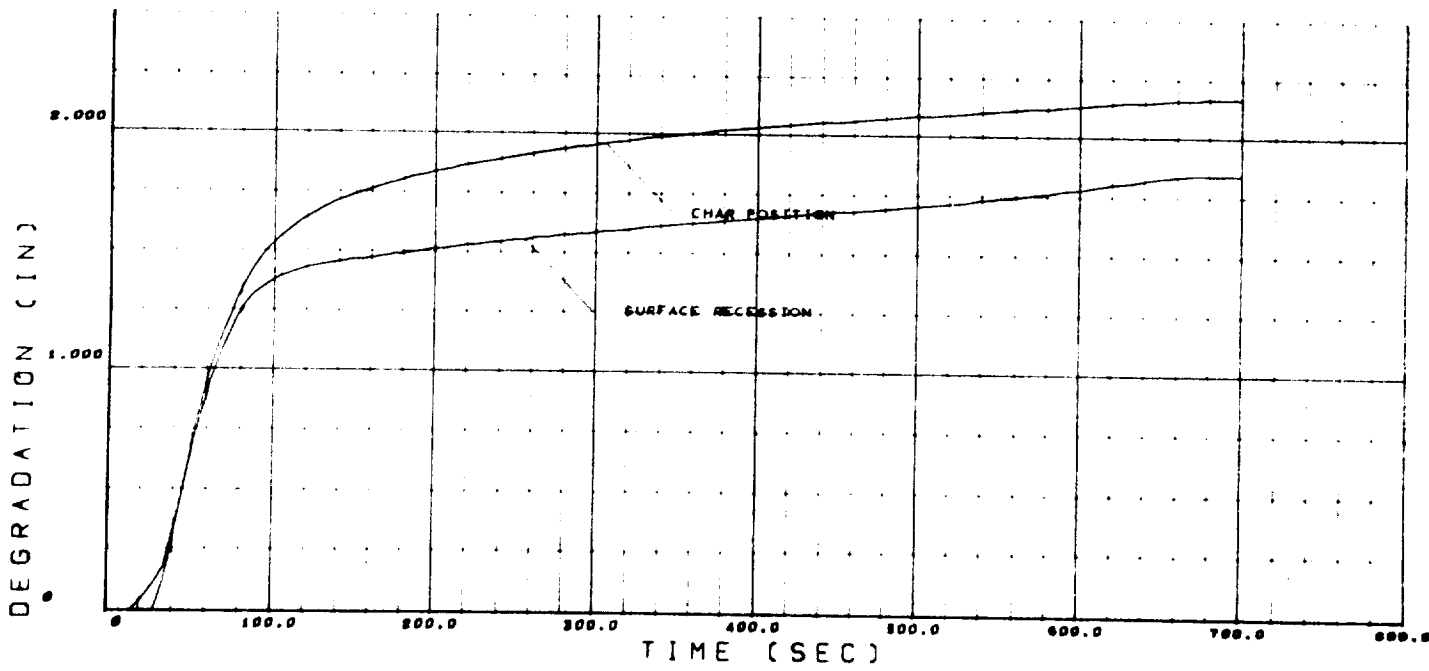
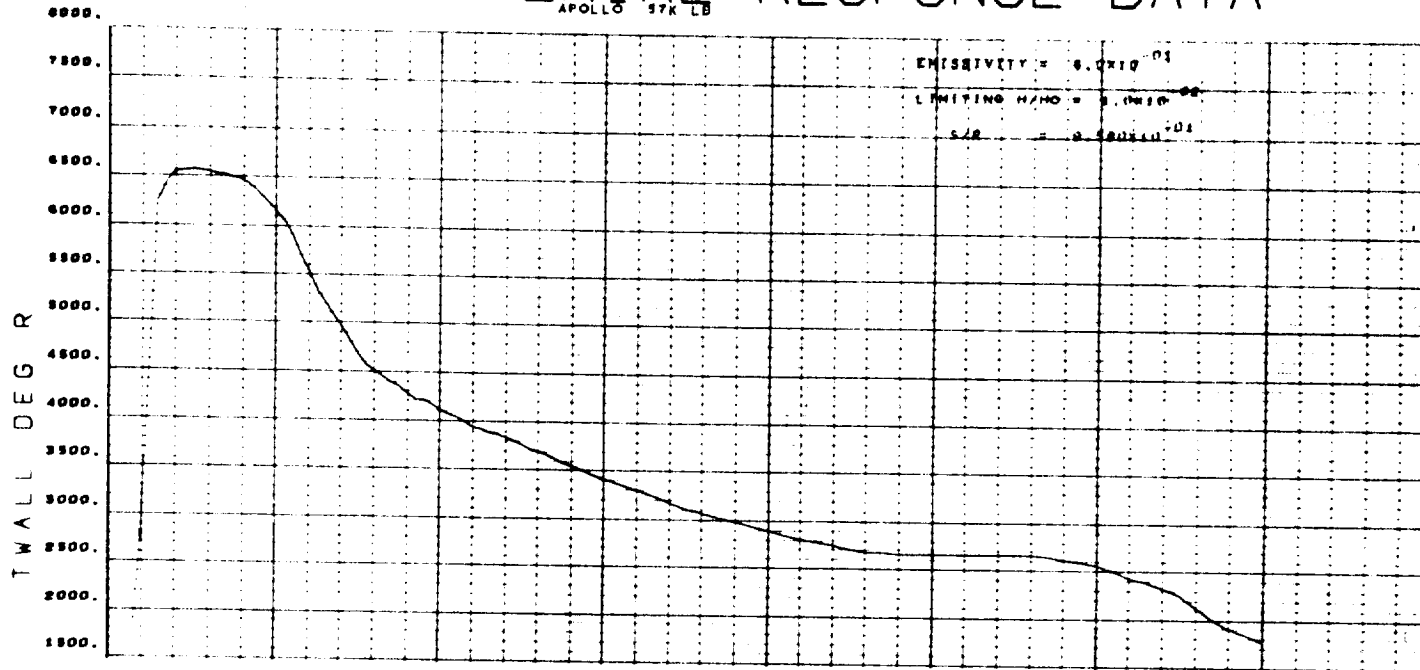


FIGURE A-36

ENERGY ACCOMMODATION MECHANISMS

APOLLO 37R LB

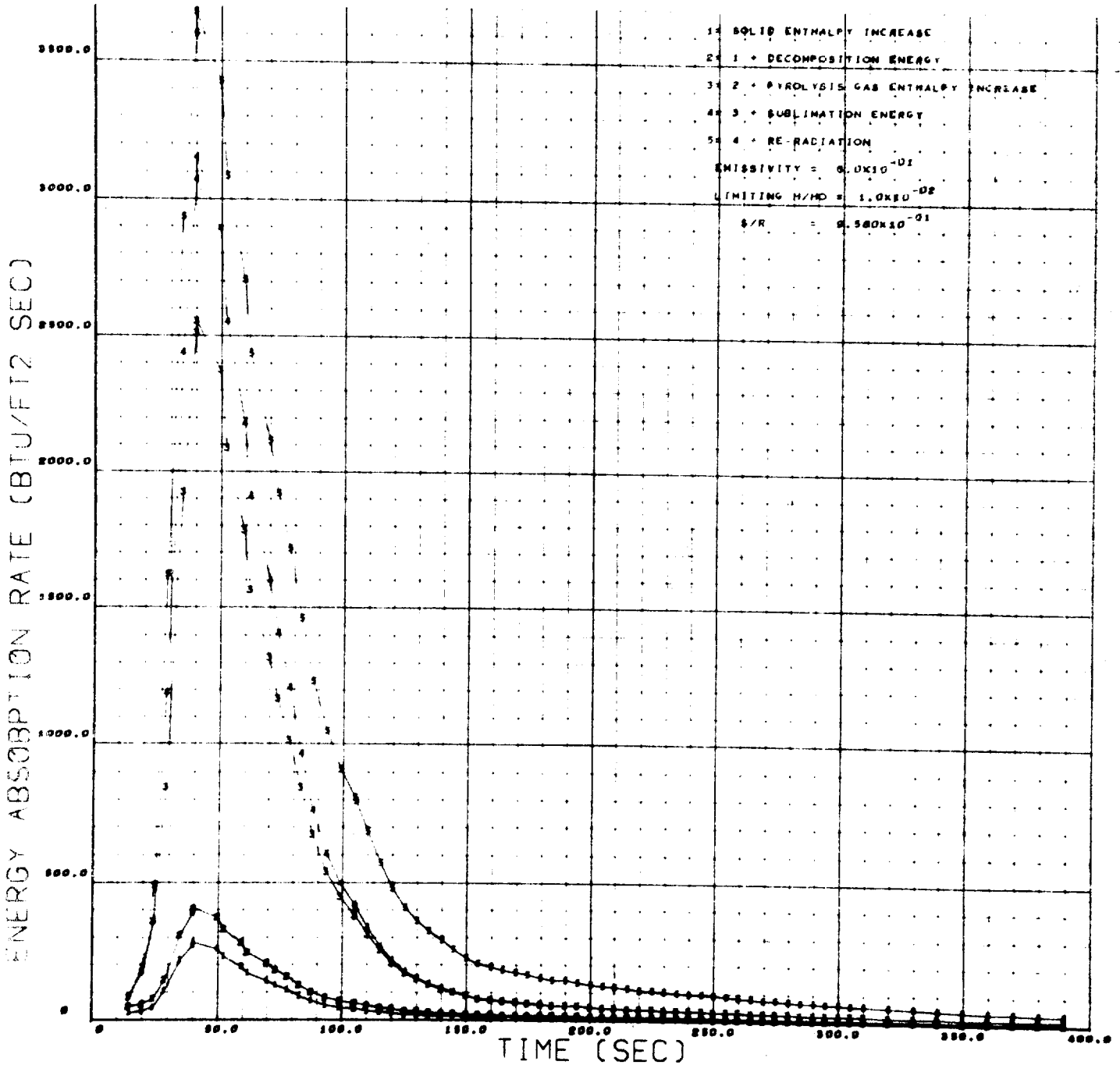


FIGURE A37

HEATING RATE HISTORY

APOLLO 37K LB

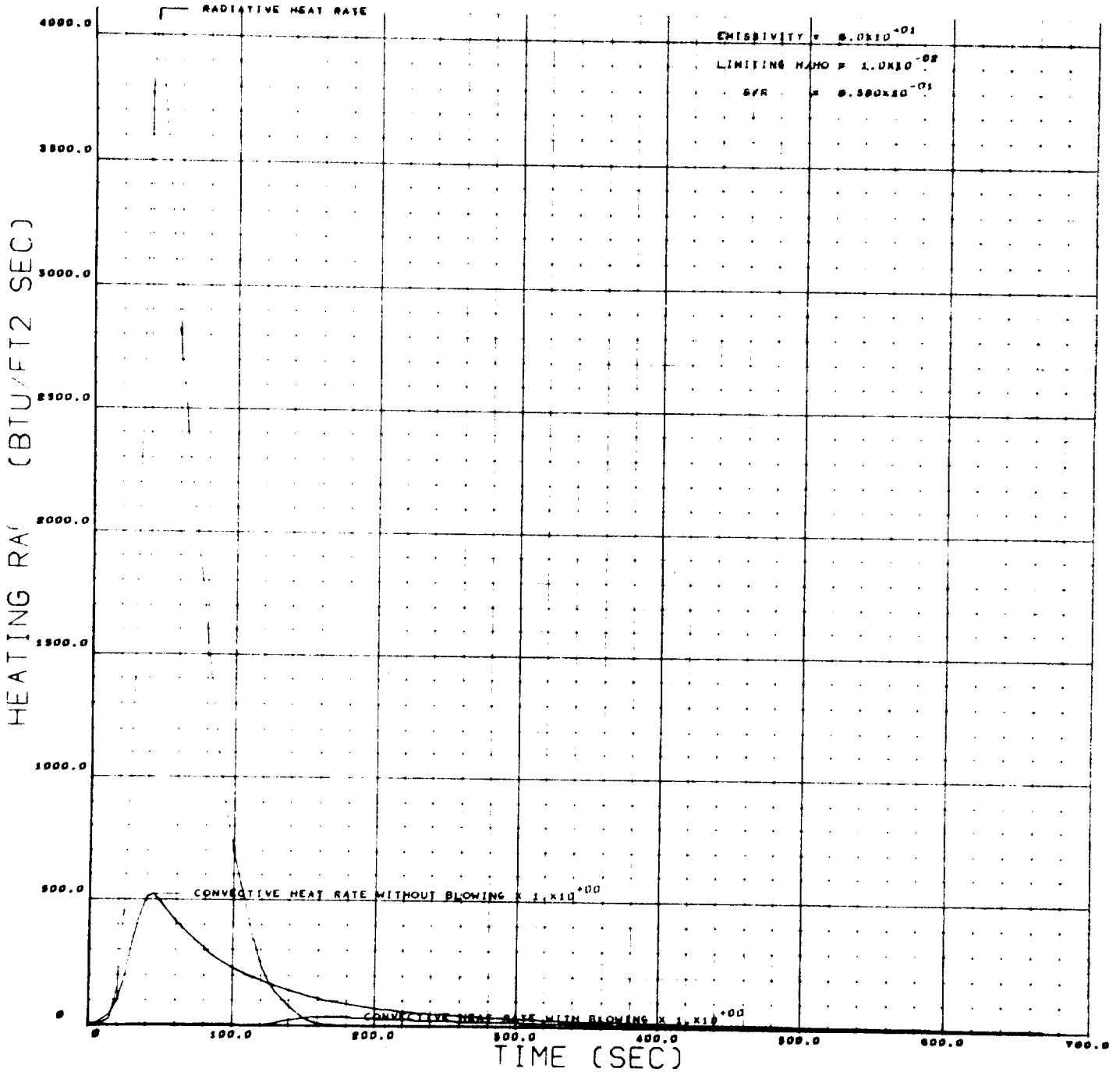


FIGURE A57

MATERIAL RESPONSE DATA

APOLLO 37K LB

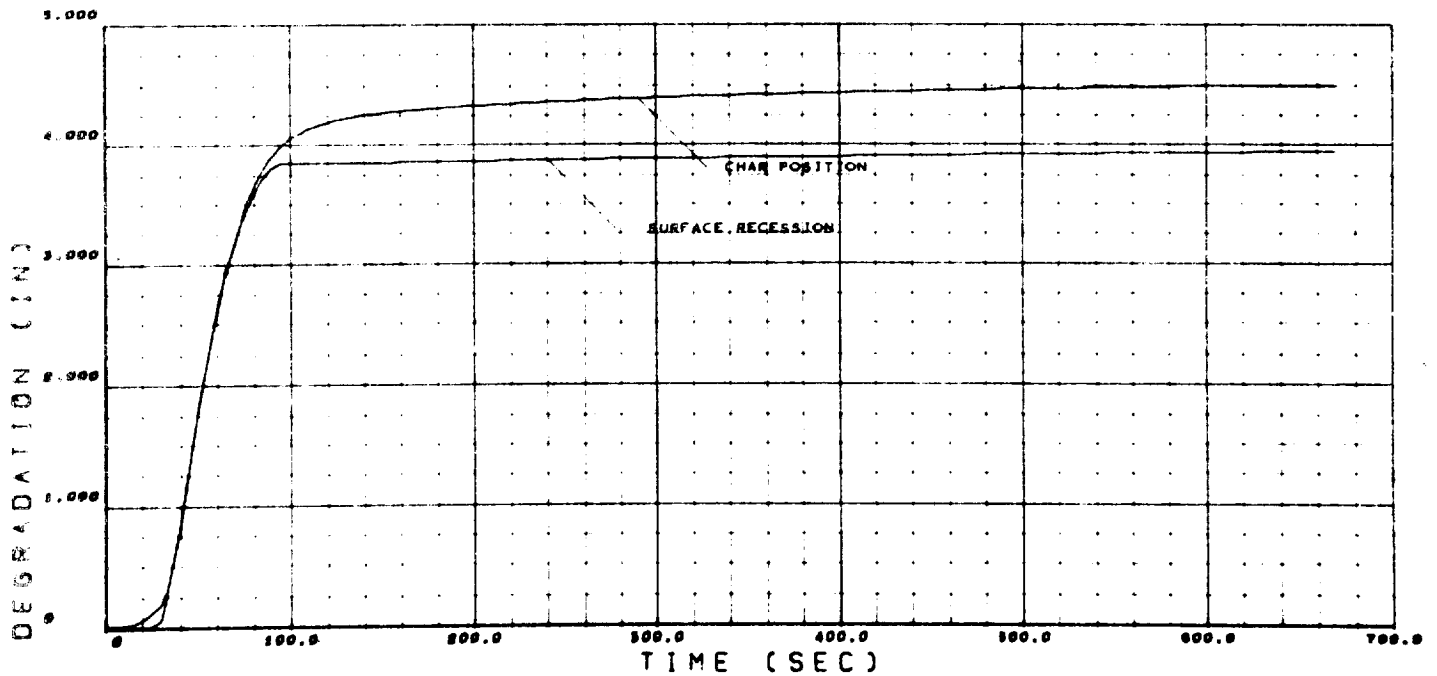
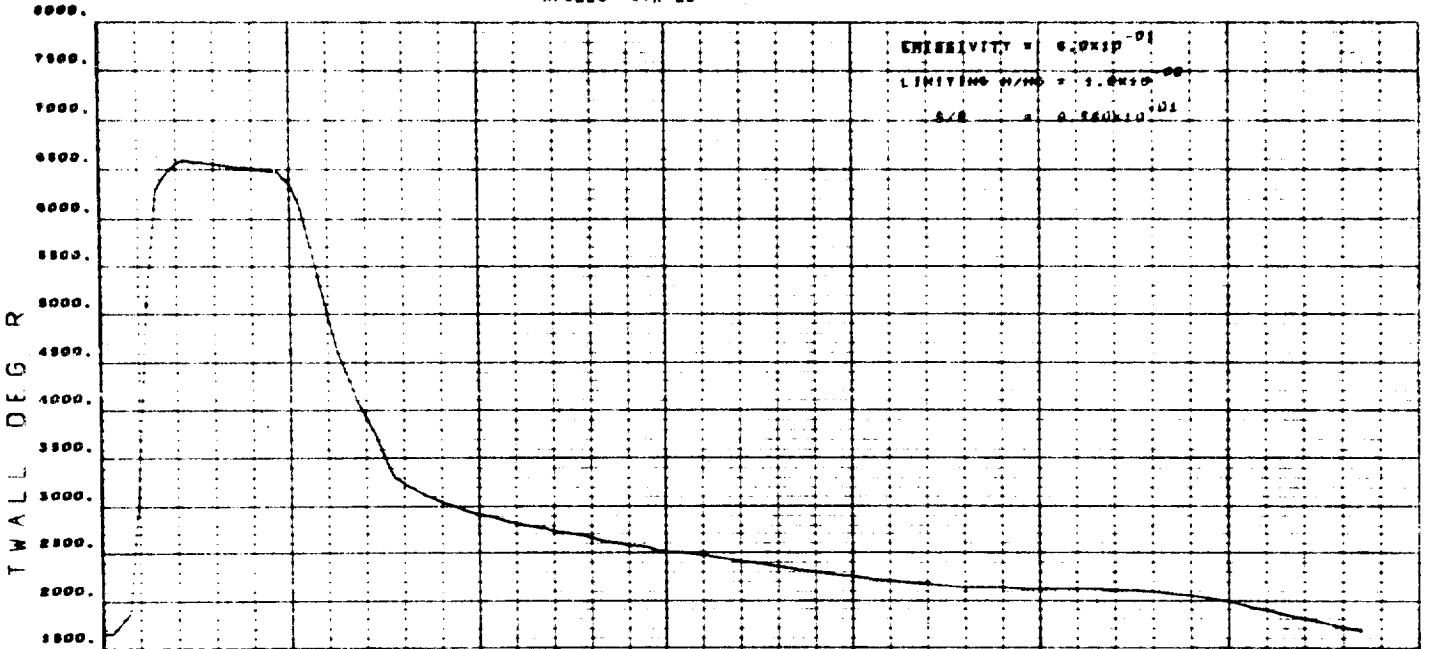


FIGURE A37

ENERGY ACCOMMODATION MECHANISMS

APOLLO 37K LB

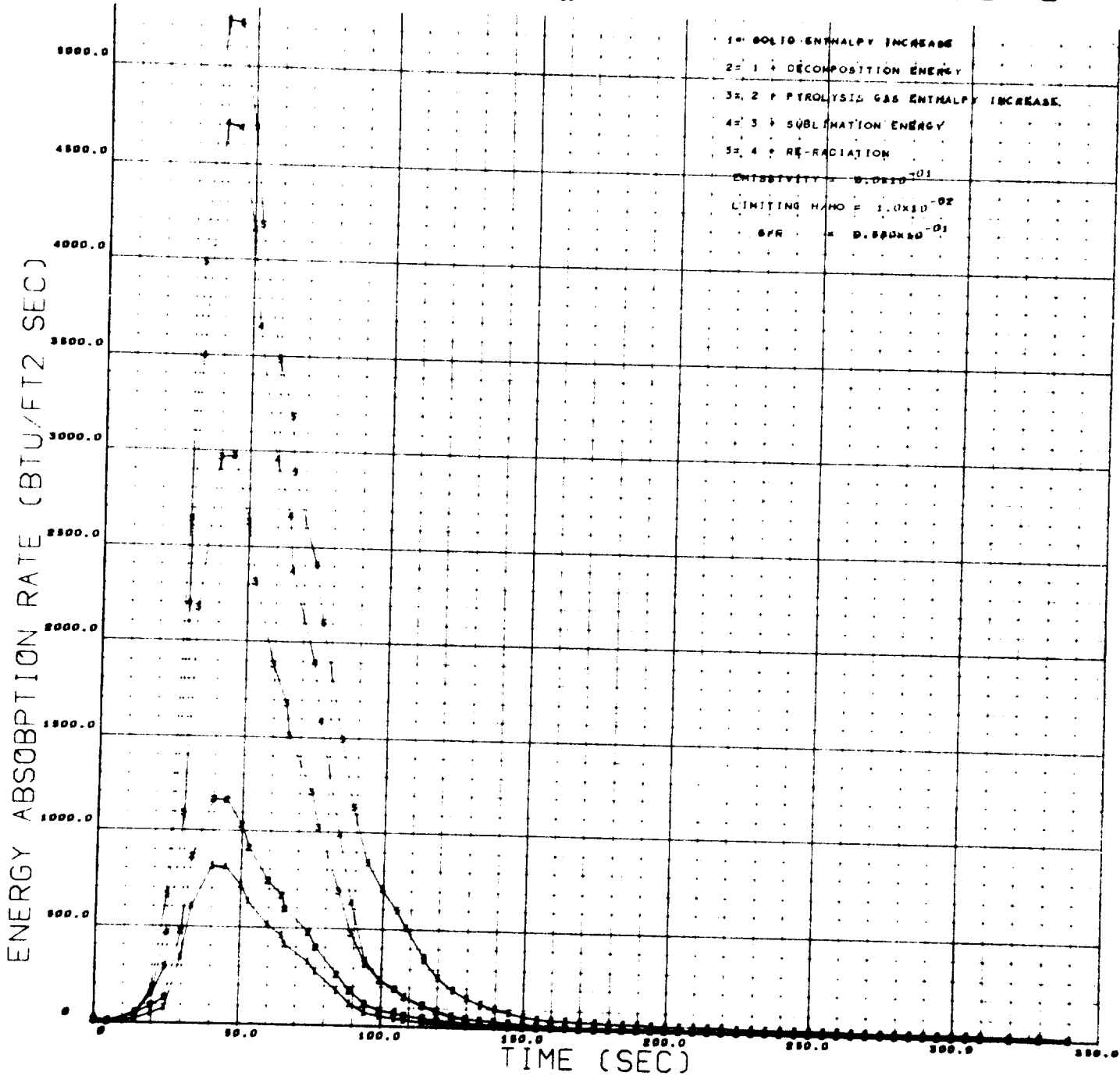


FIGURE A-38

HEATING RATE HISTORY

APOLLO 17K LB

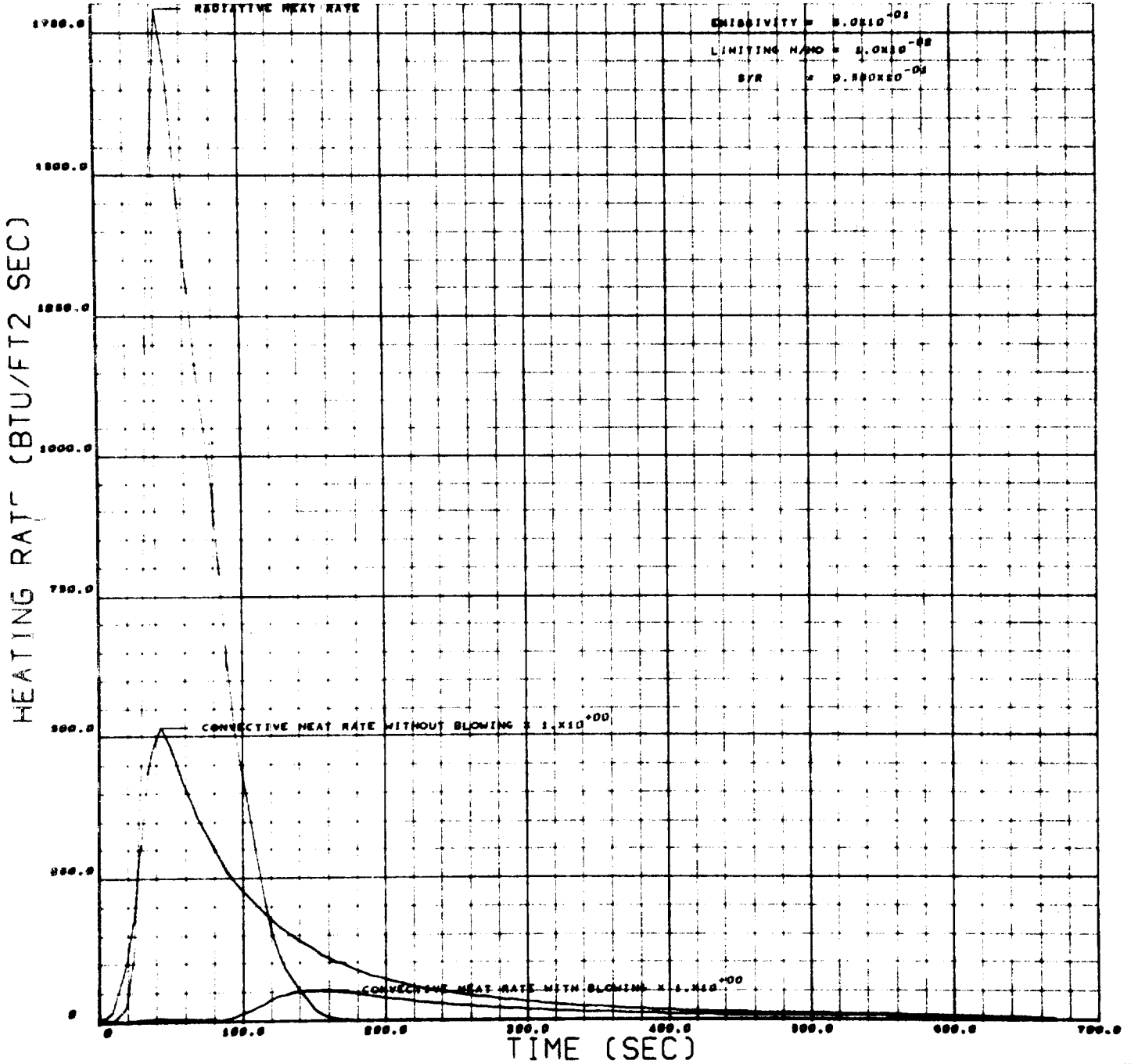


FIGURE A38

MATERIAL RESPONSE DATA

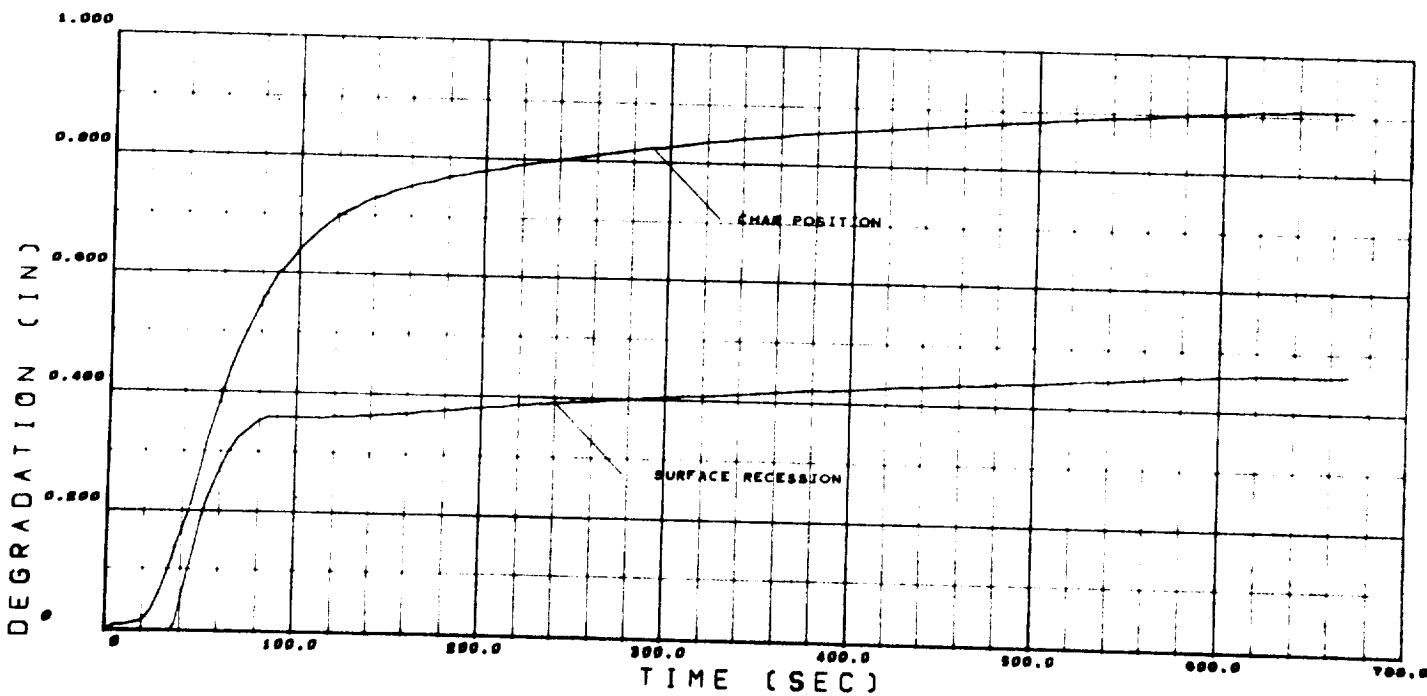
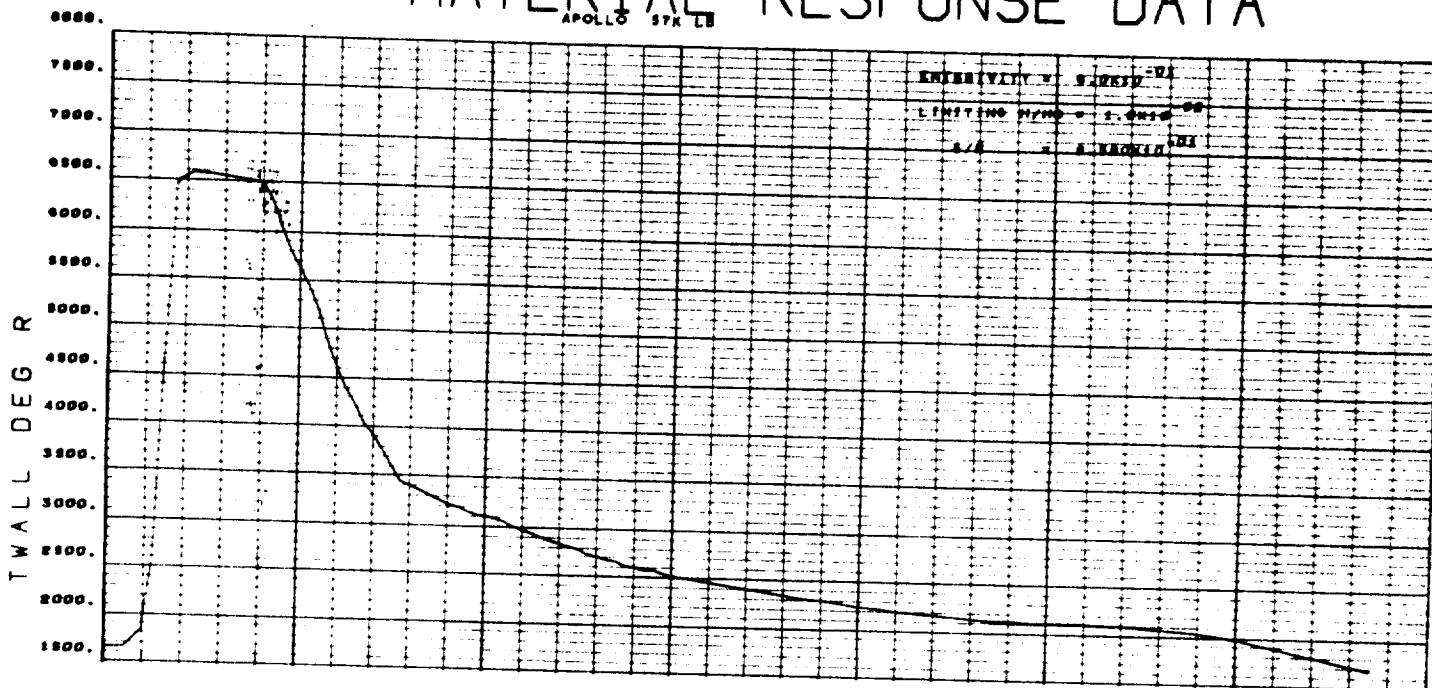


FIGURE A38

ENERGY ACCOMMODATION MECHANISMS

APOLLO 17A LB

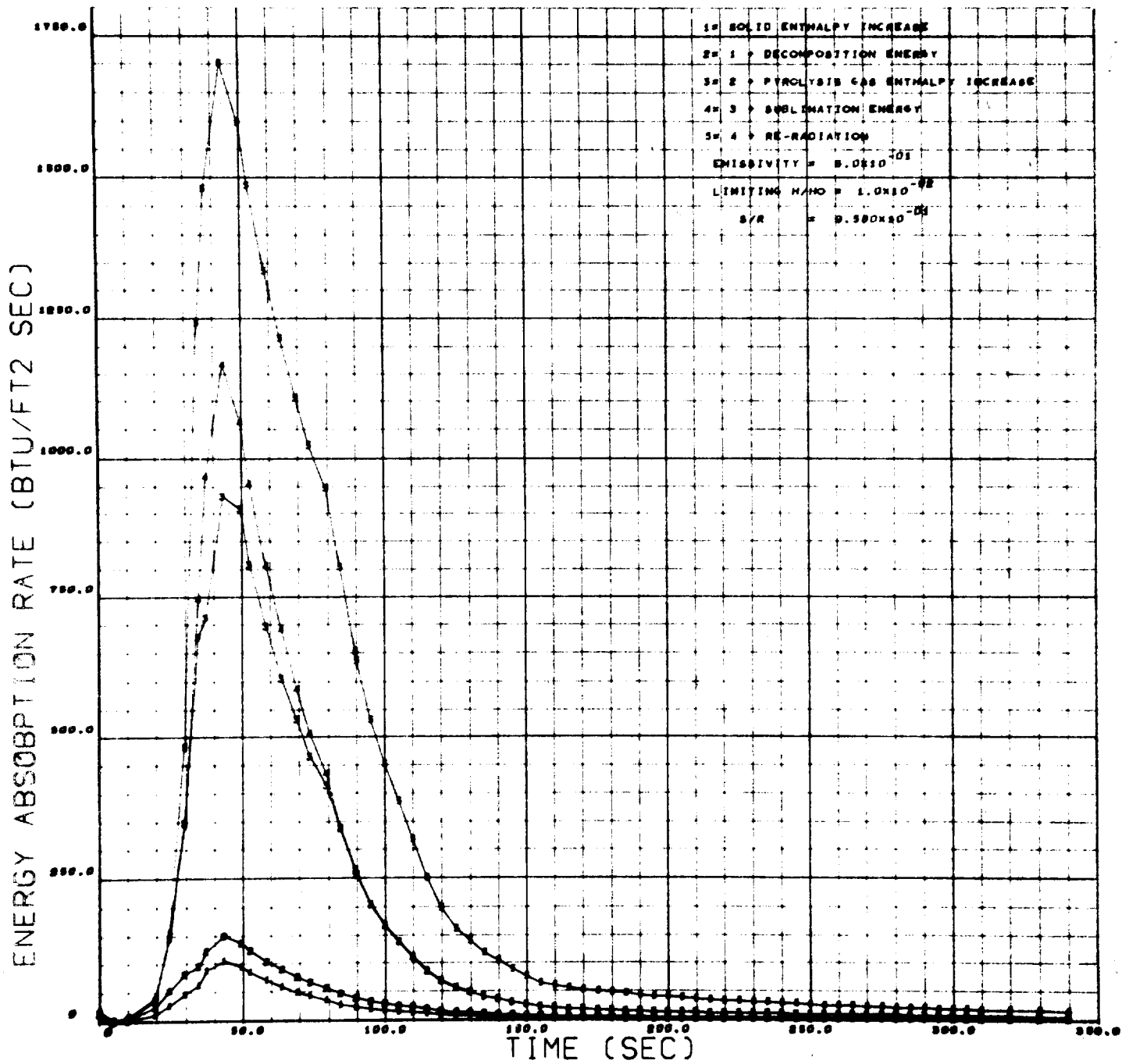


FIGURE A-39

HEATING RATE HISTORY

APOLLO 37K LB

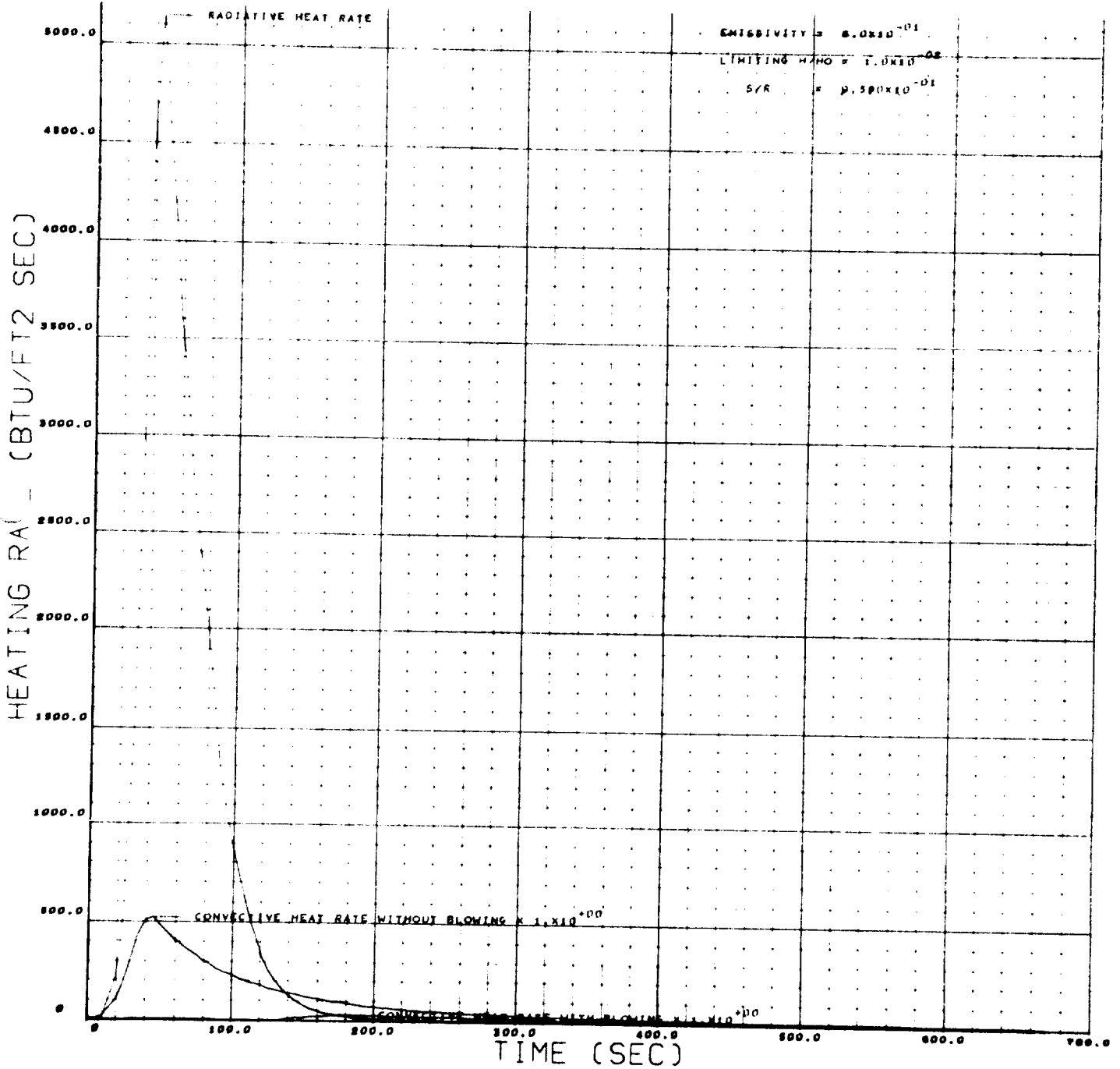


FIGURE A-39

MATERIAL RESPONSE DATA

APOLLO 57K LB

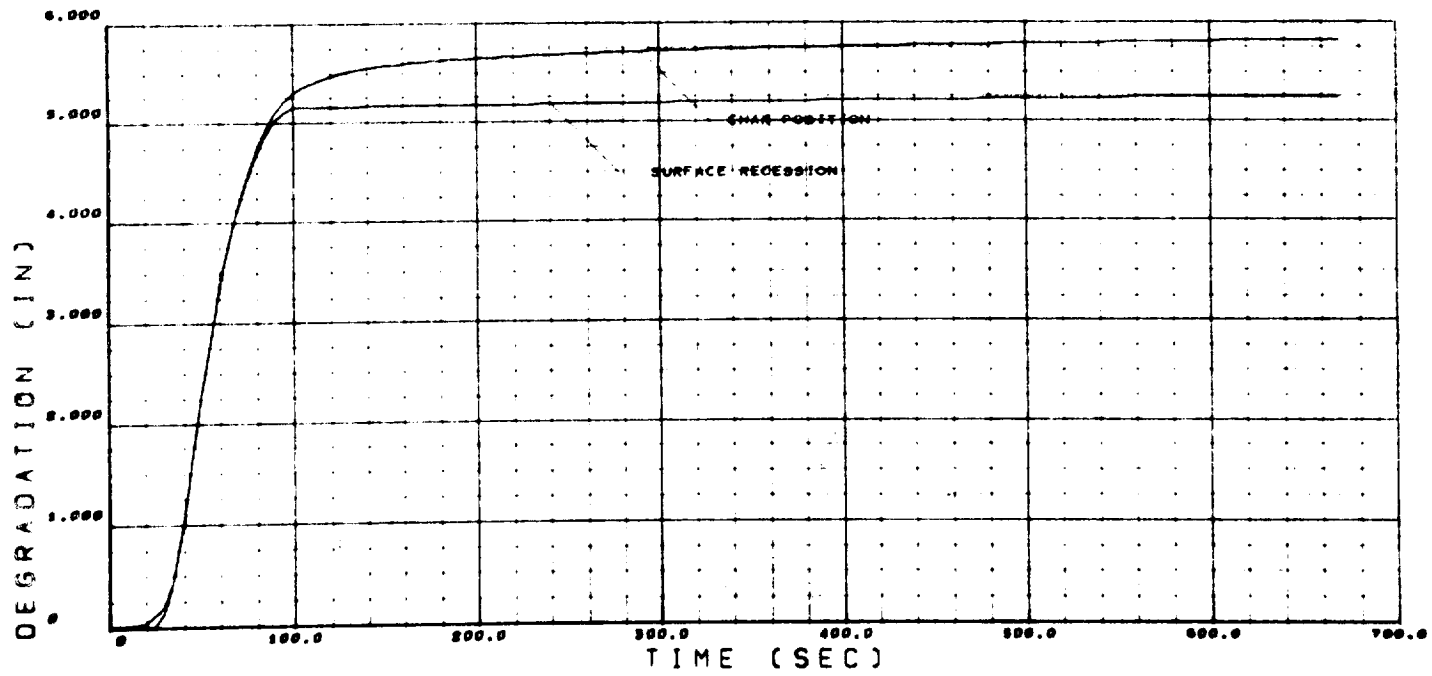
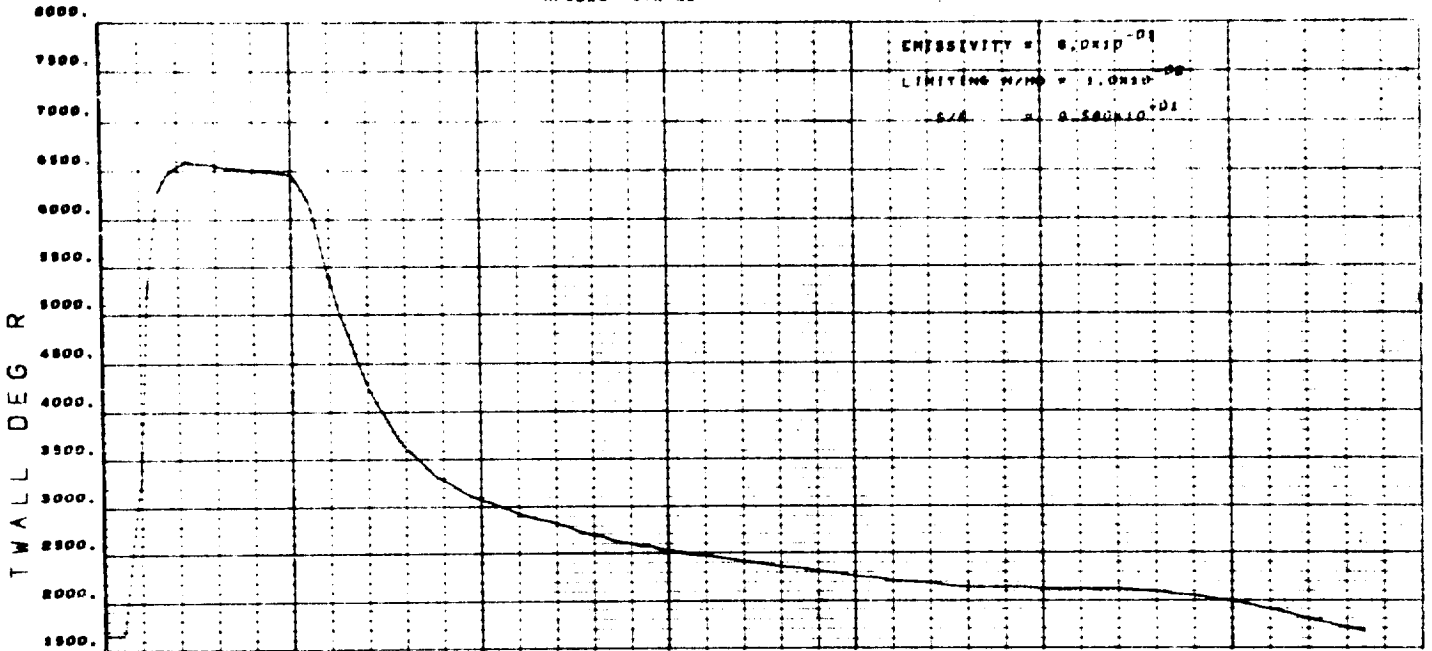


FIGURE A-39

ENERGY ACCOMMODATION MECHANISMS

APOLLO 37K LC

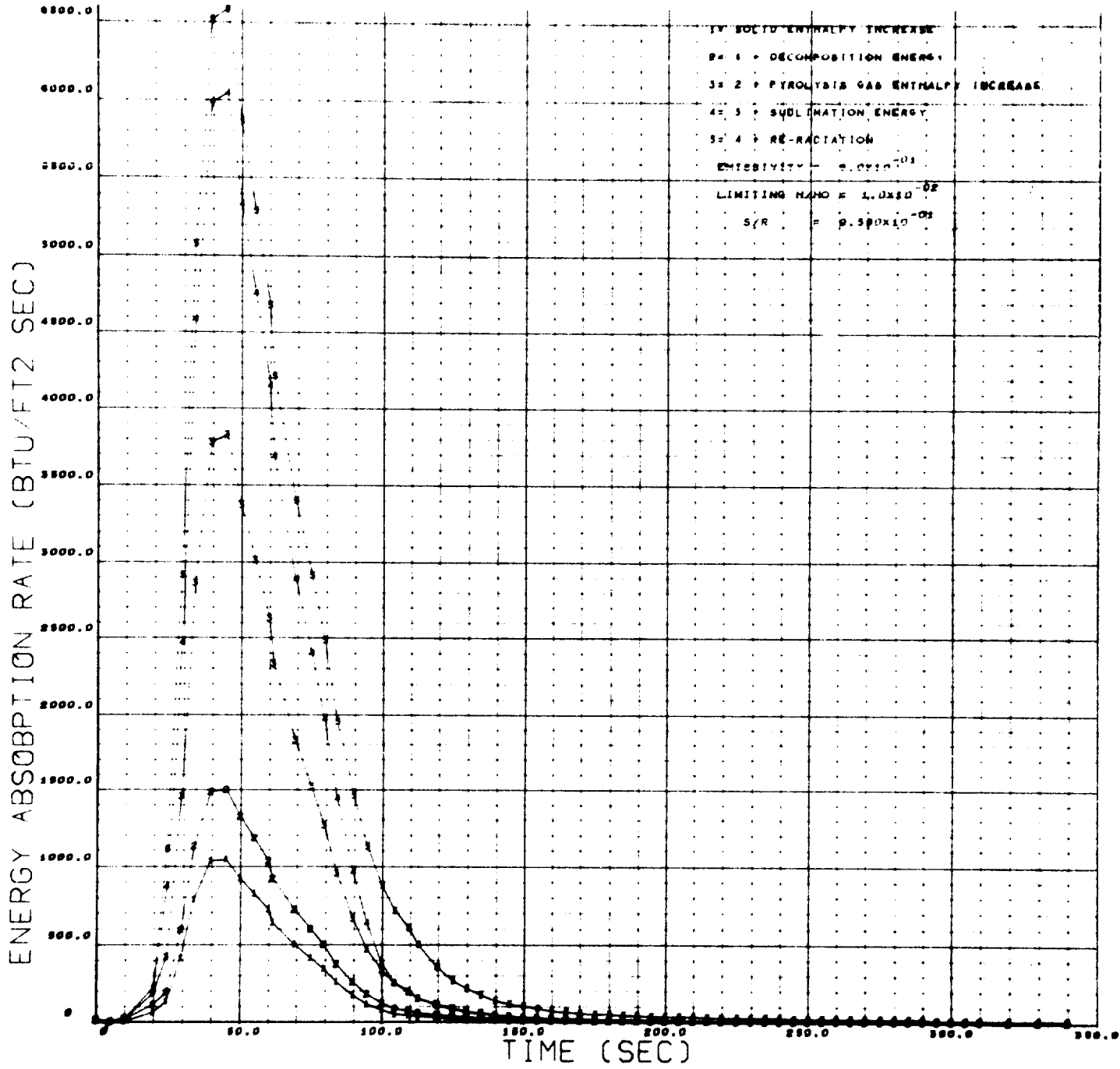


FIGURE A 40

HEATING RATE HISTORY

APOLLO - VESOR - INTERMEDIATE CORRIDOR POSITION

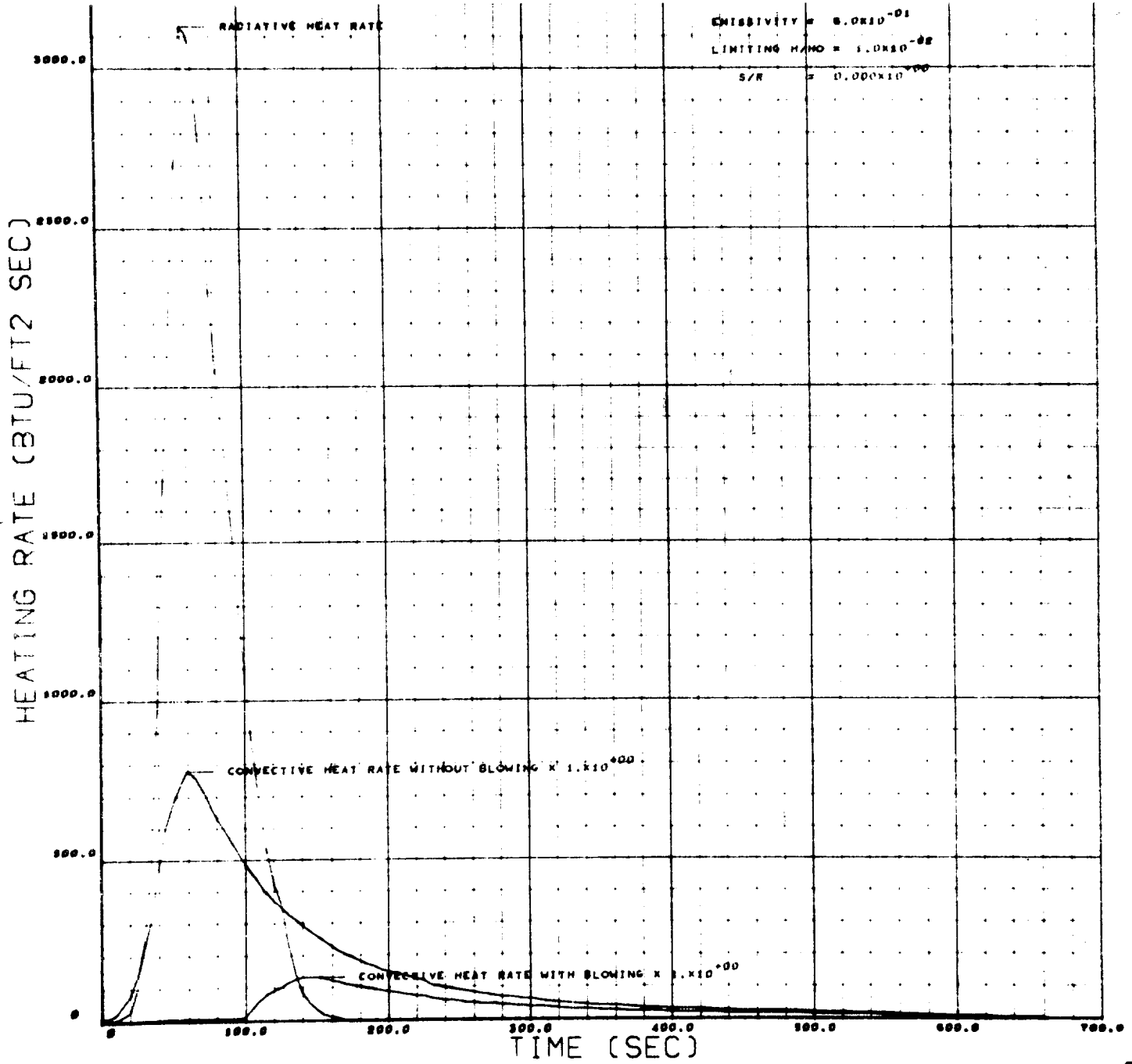


FIGURE A 40

MATERIAL RESPONSE DATA

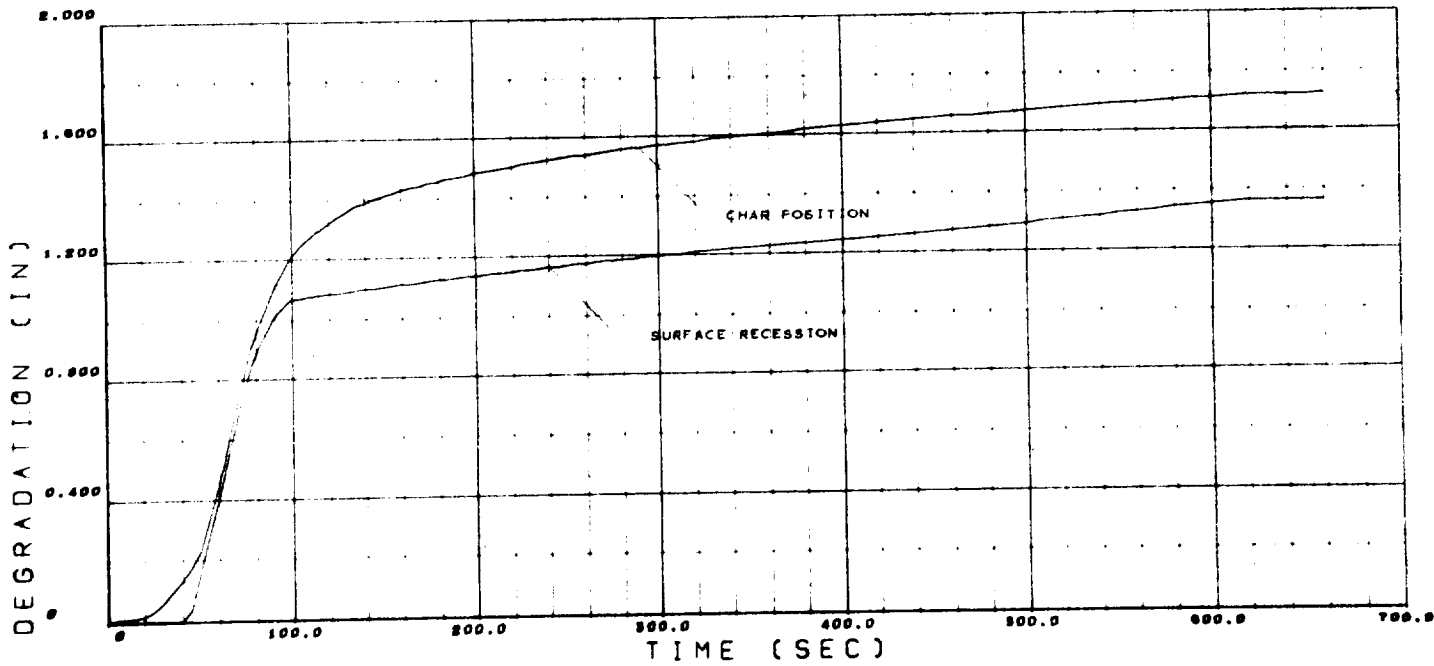
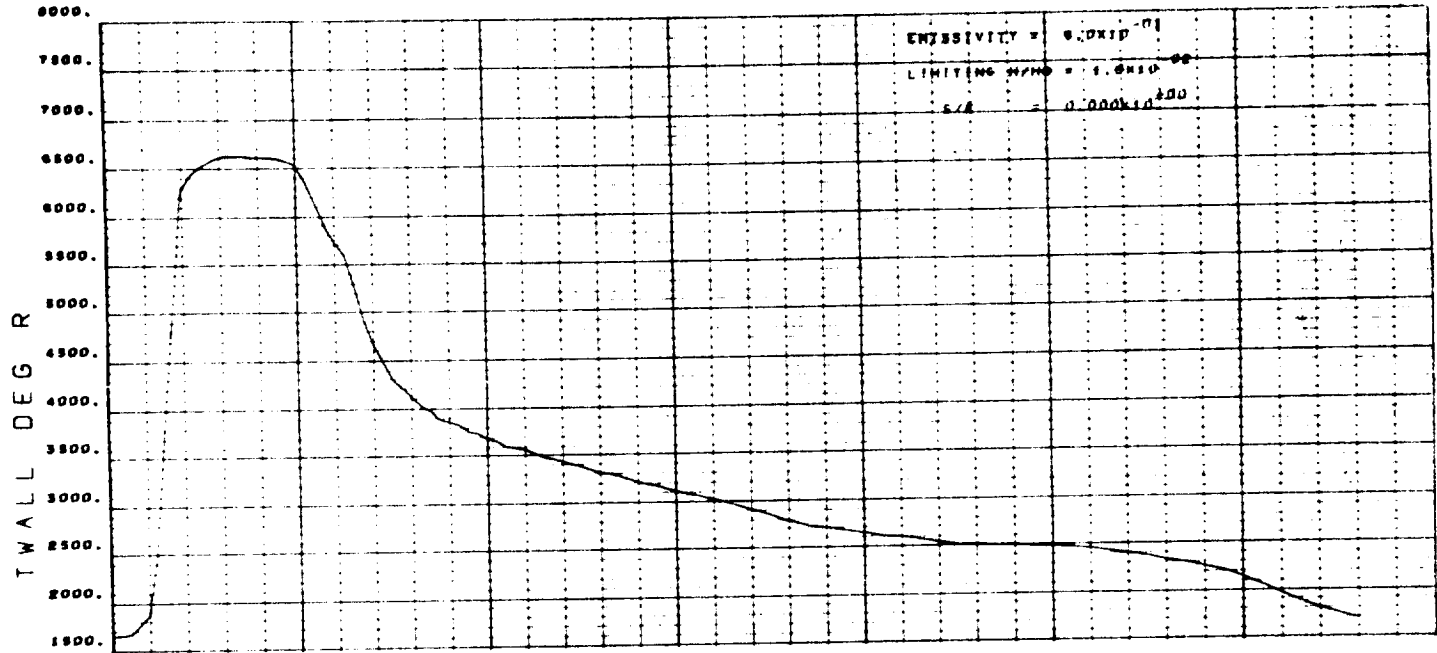


FIGURE A 40

ENERGY ACCOMMODATION MECHANISMS

APOLLO VE=50K INTERMEDIATE CORRIDOR POSITION

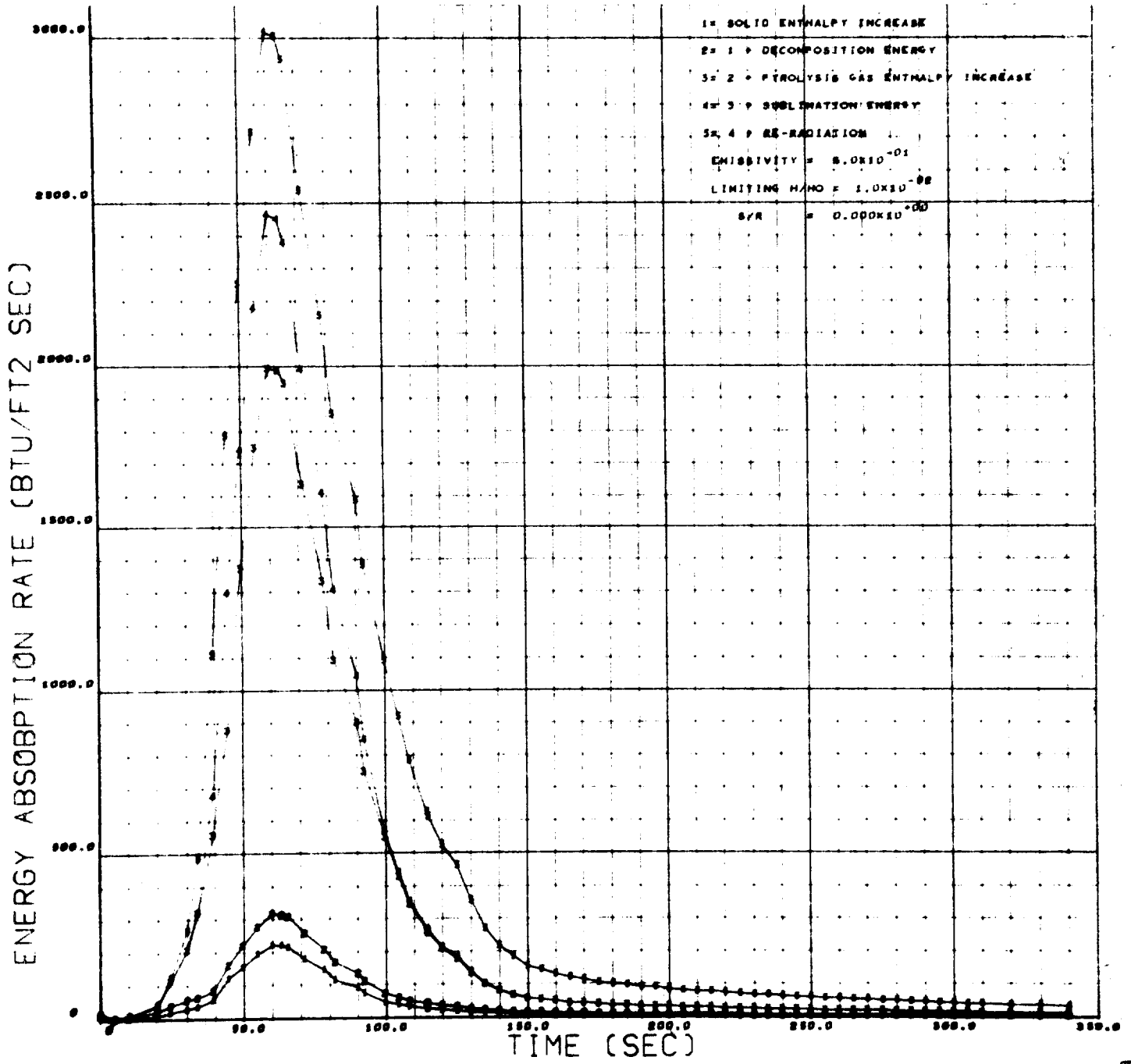


FIGURE A 41

HEATING RATE HISTORY

APOLLO VESOK INTERMEDIATE CORRIDOR POSITION

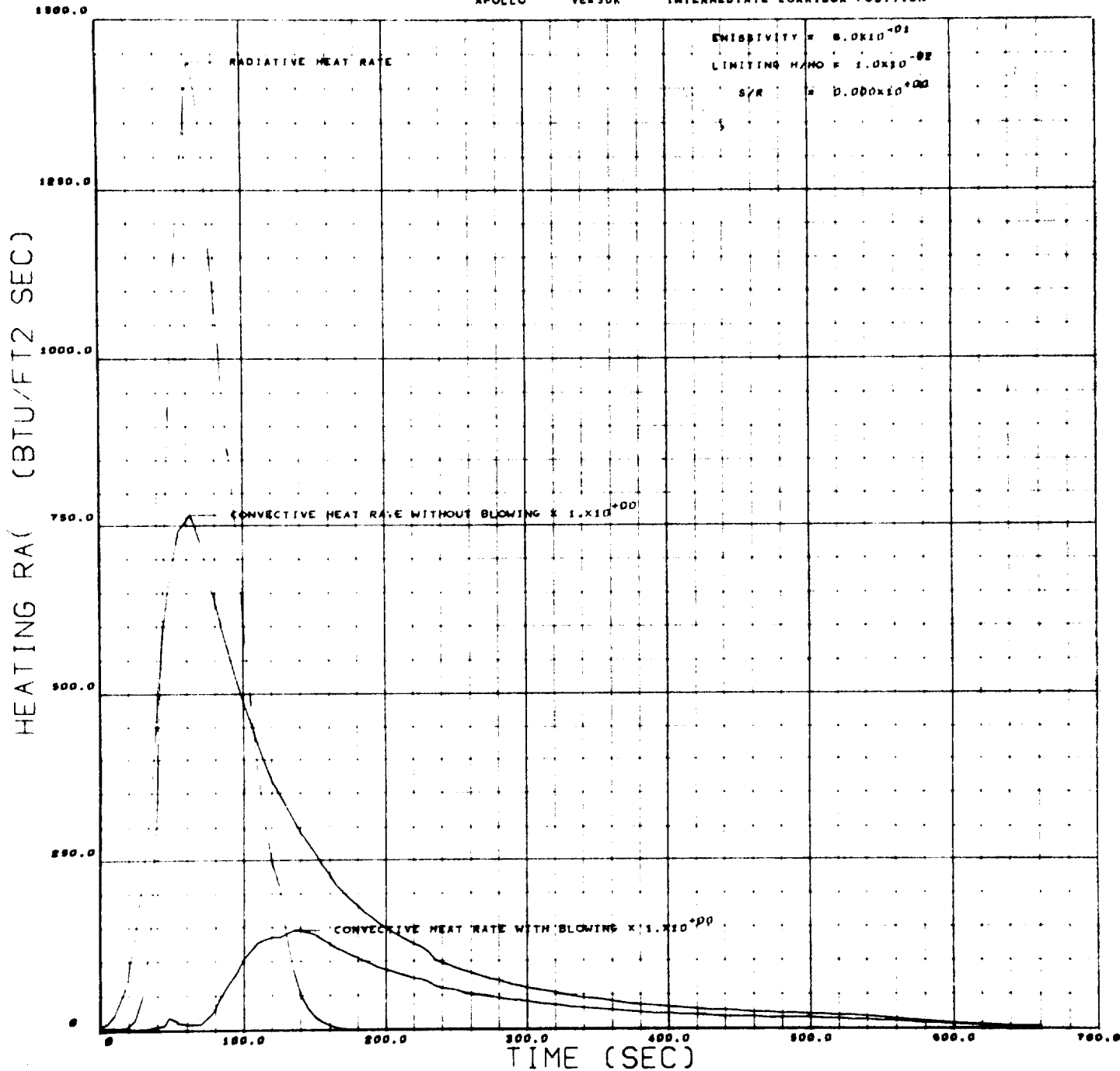


FIGURE A 41

MATERIAL RESPONSE DATA

APOLLO VESSEL INTERMEDIATE CORRIDOR POSITION

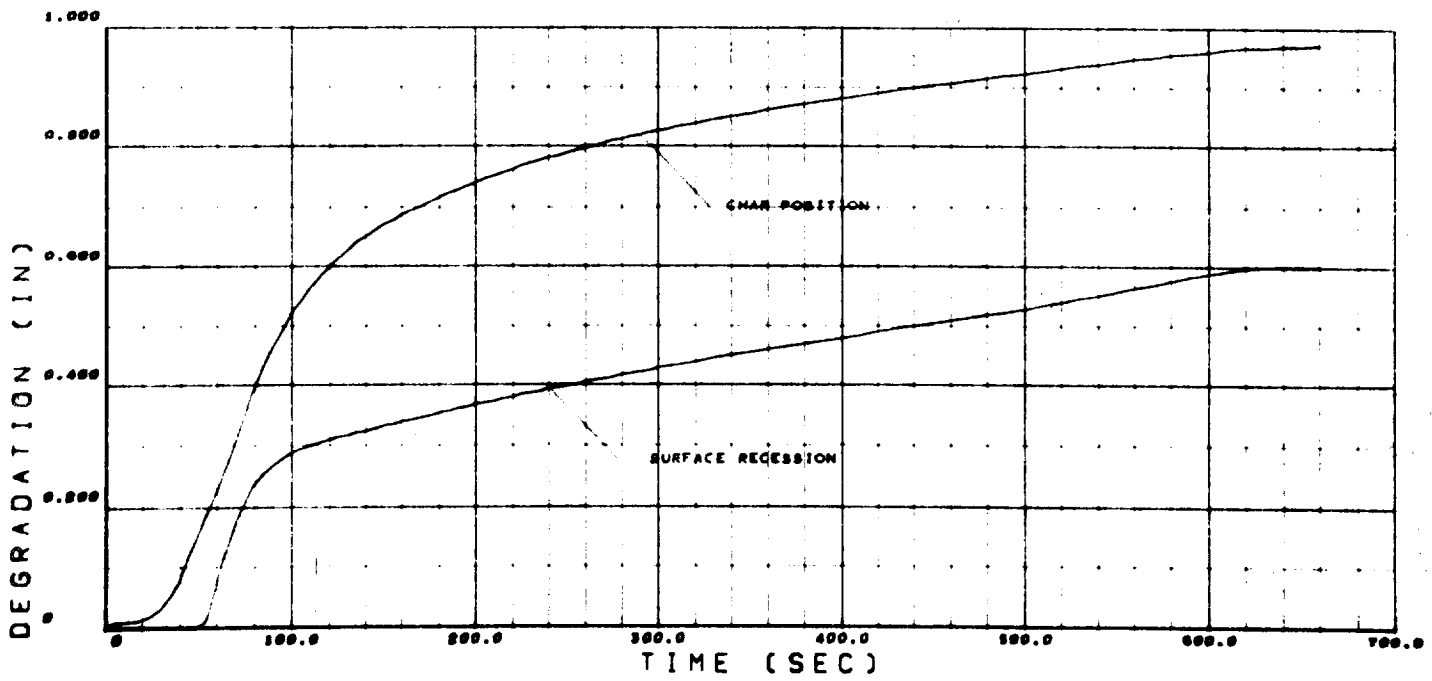
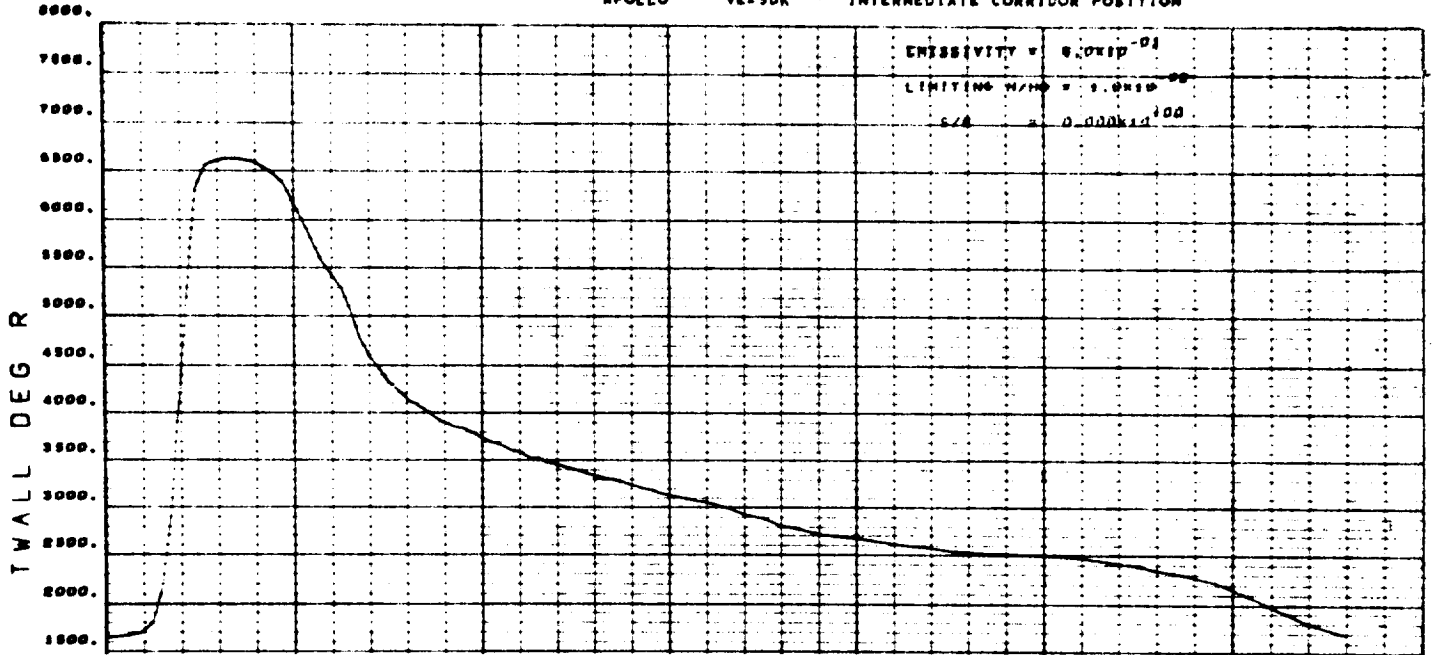


FIGURE A 41

ENERGY ACCOMMODATION MECHANISMS

APOLLO VE=50K INTERMEDIATE CORRIDOR POSITION

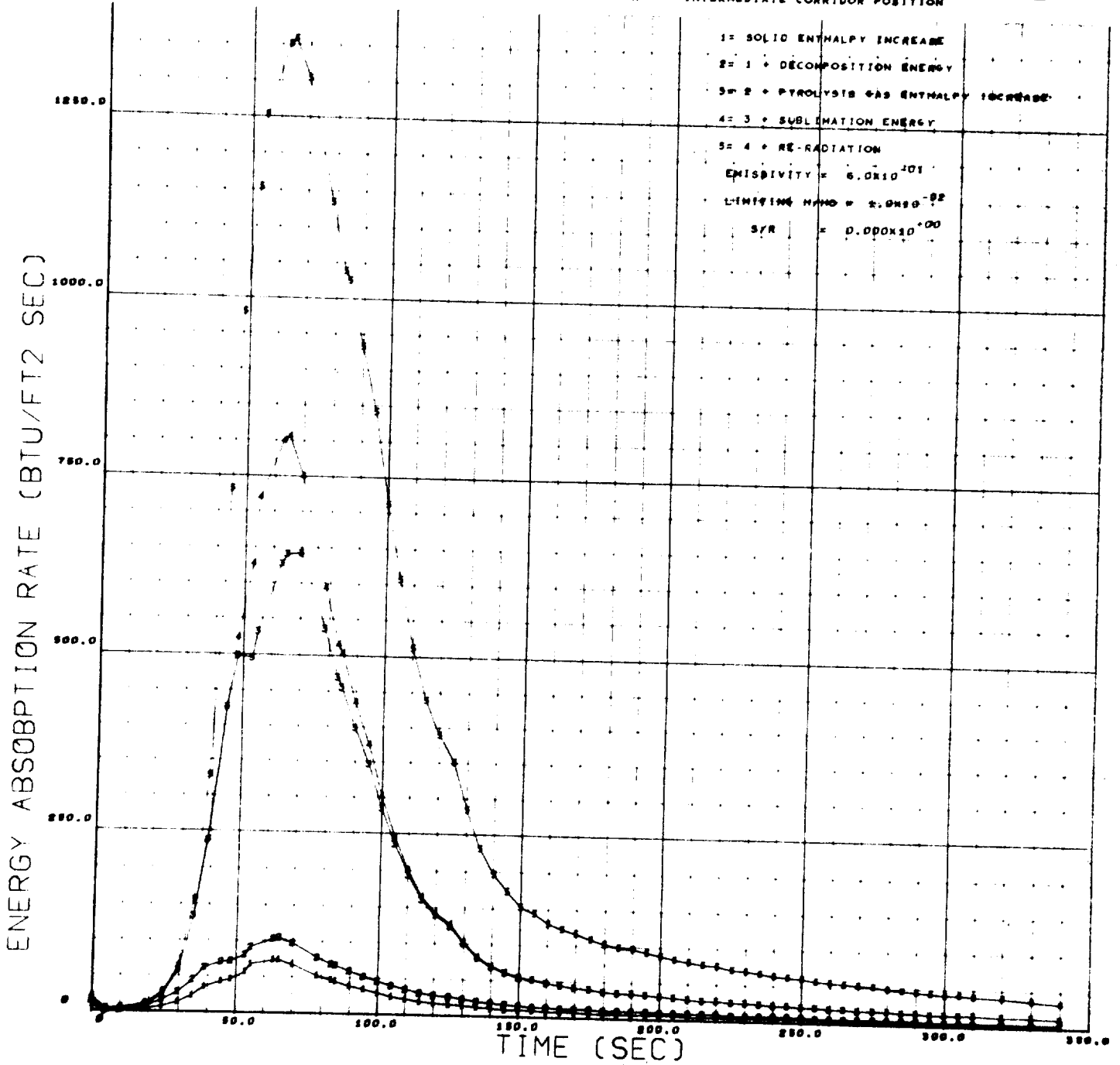


FIGURE A 42

HEATING RATE HISTORY

APOLLO VE=50K INTERMEDIATE CORRIDOR POSITION

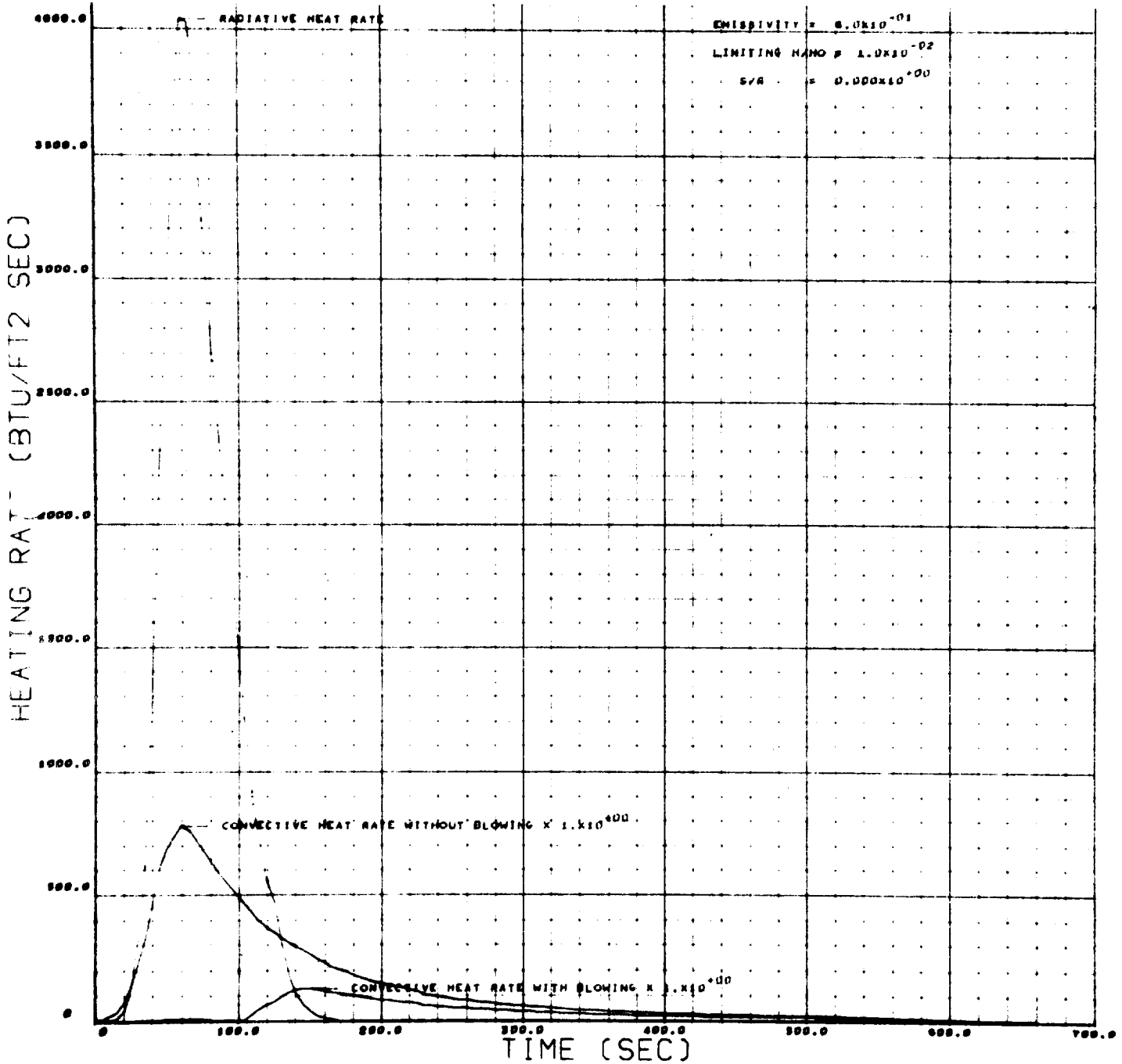


FIGURE A 42

MATERIAL RESPONSE DATA

APOLLO VE=50K INTERMEDIATE CORRIDOR POSITION

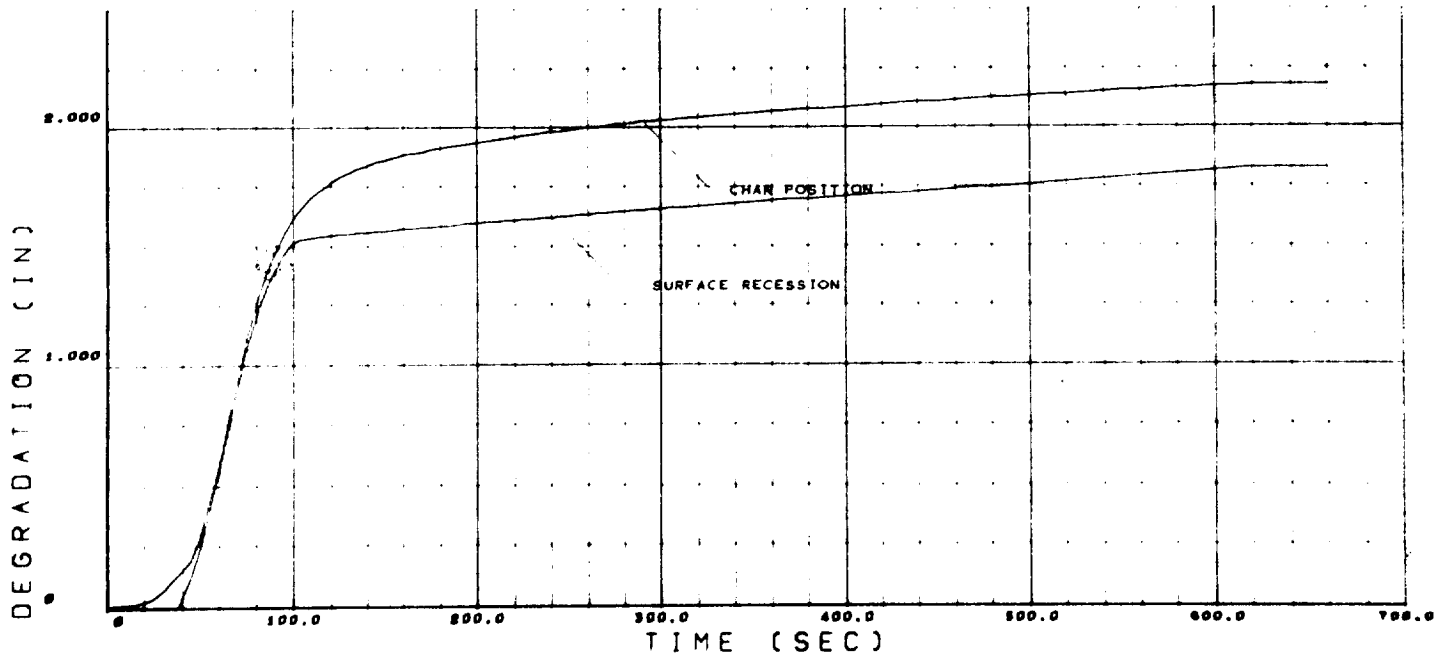
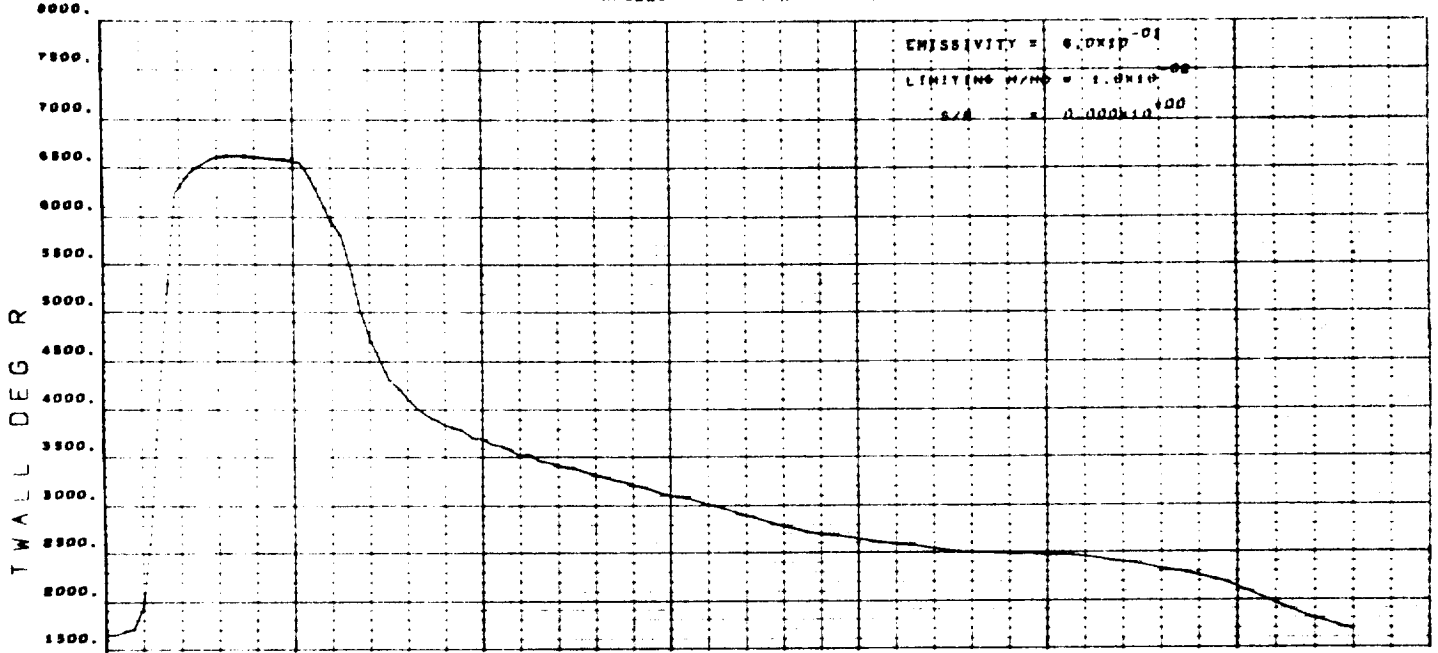


FIGURE A 4R

ENERGY ACCOMMODATION MECHANISMS

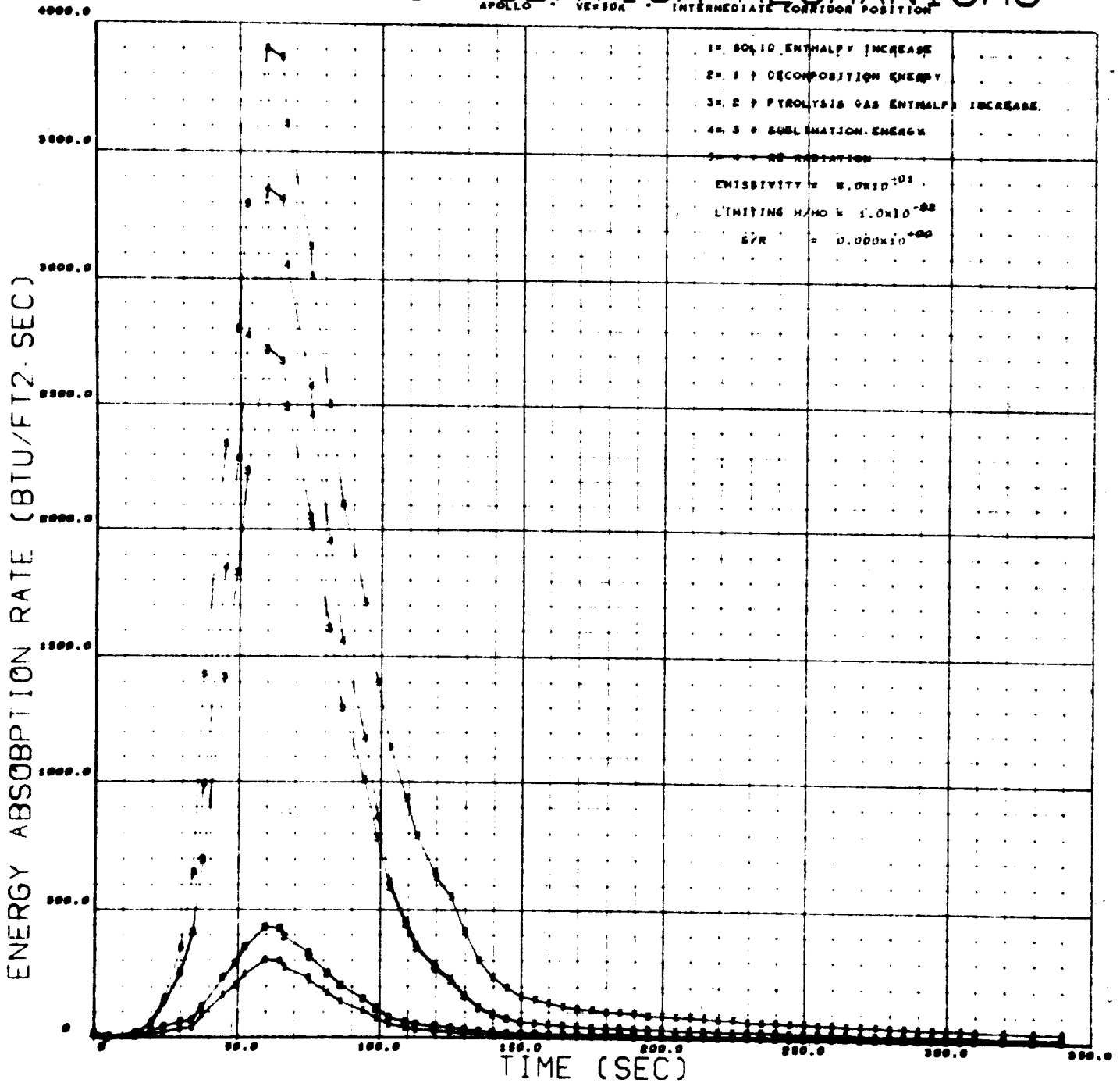


FIGURE A 43

HEATING RATE HISTORY

APOLLO VE=50K INTERMEDIATE CORRIDOR POSITION

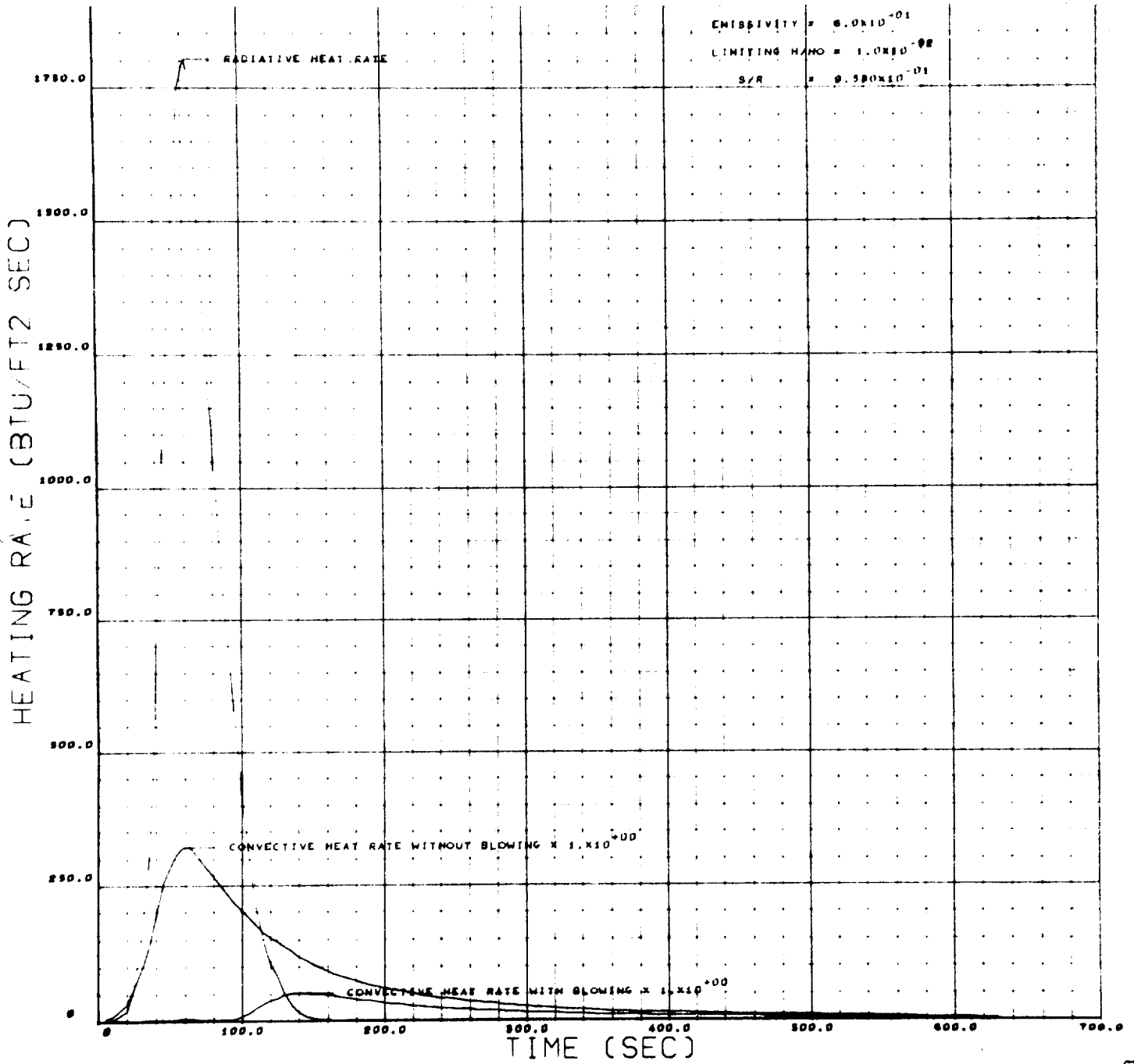


FIGURE A 43

MATERIAL RESPONSE DATA

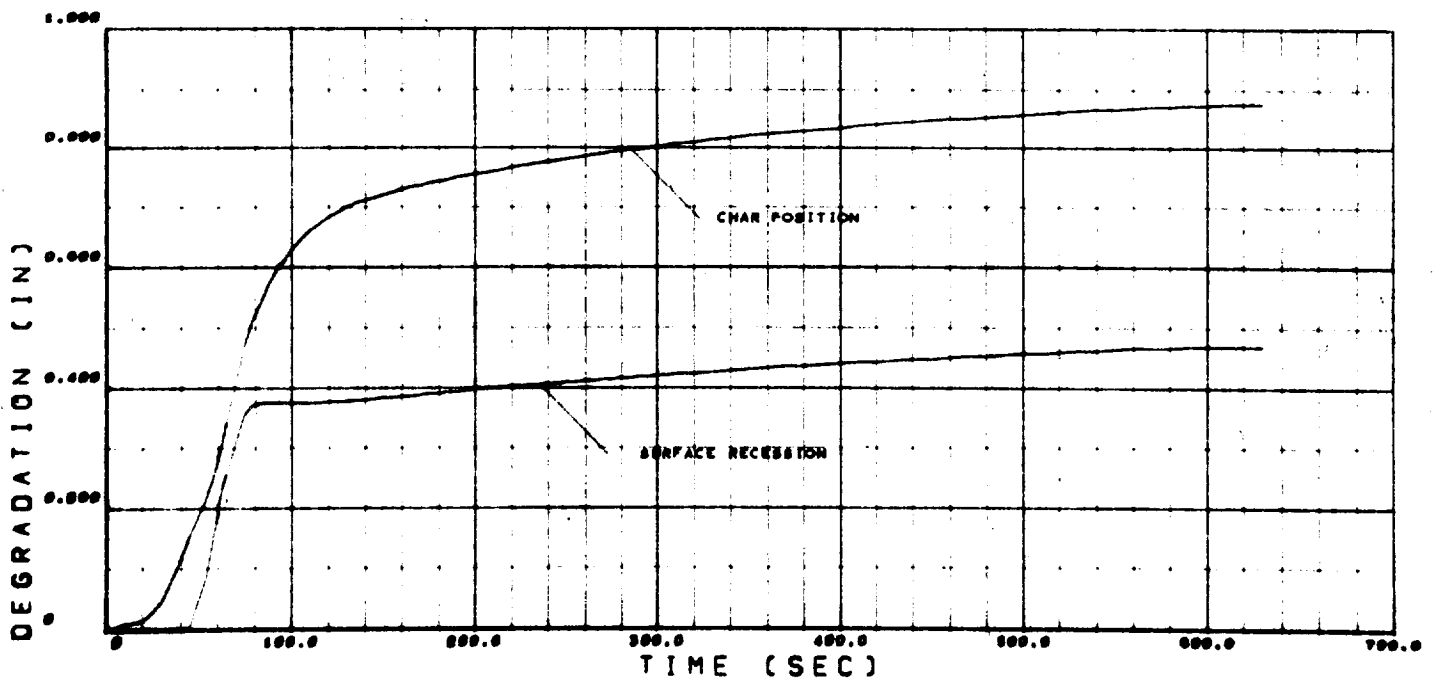
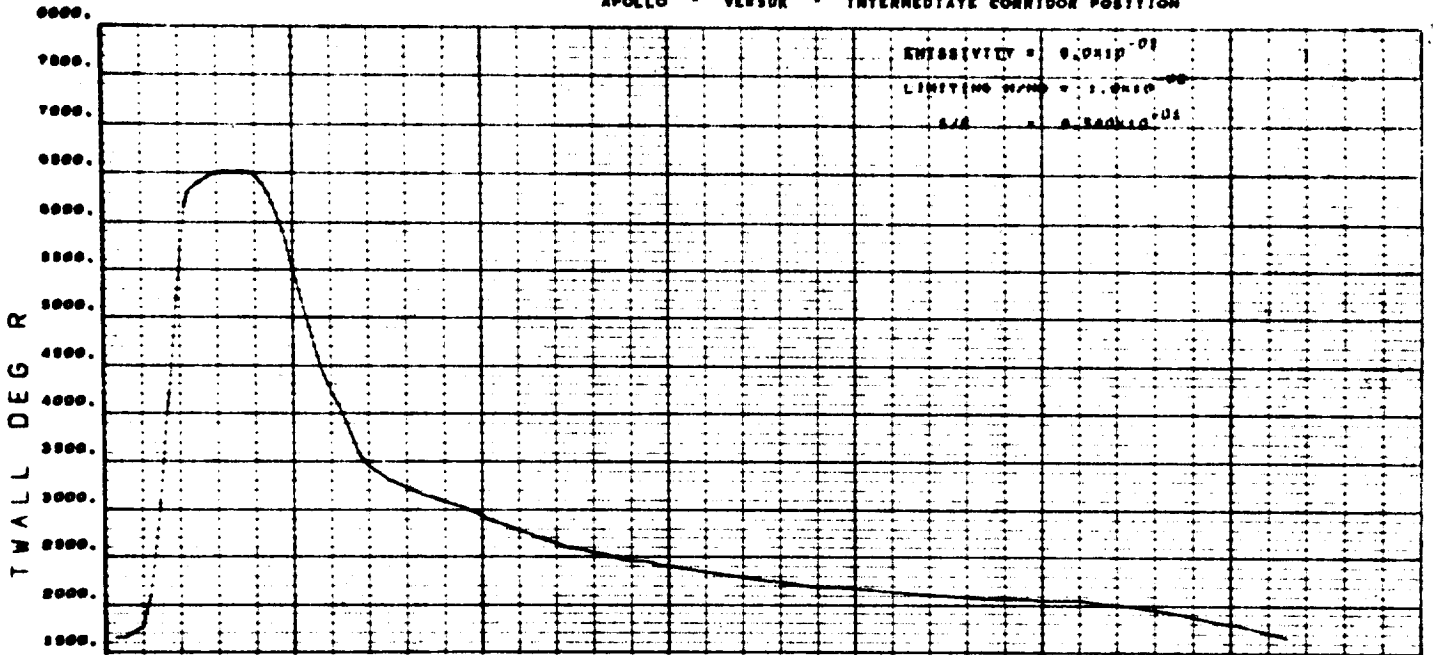


FIGURE A 43

ENERGY ACCOMMODATION MECHANISMS

APOLLO VE=90K INTERMEDIATE CORRIDOR POSITION

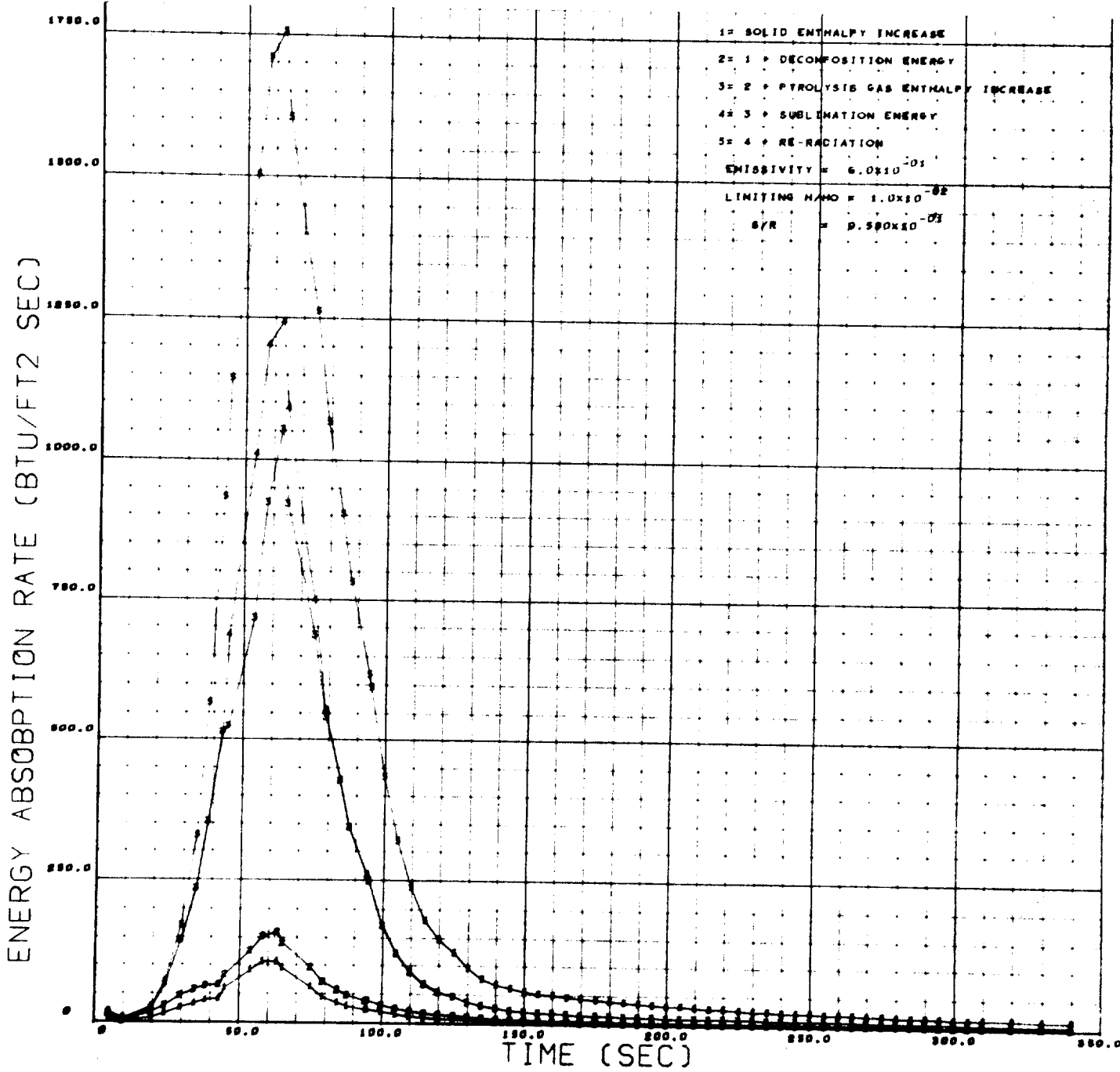
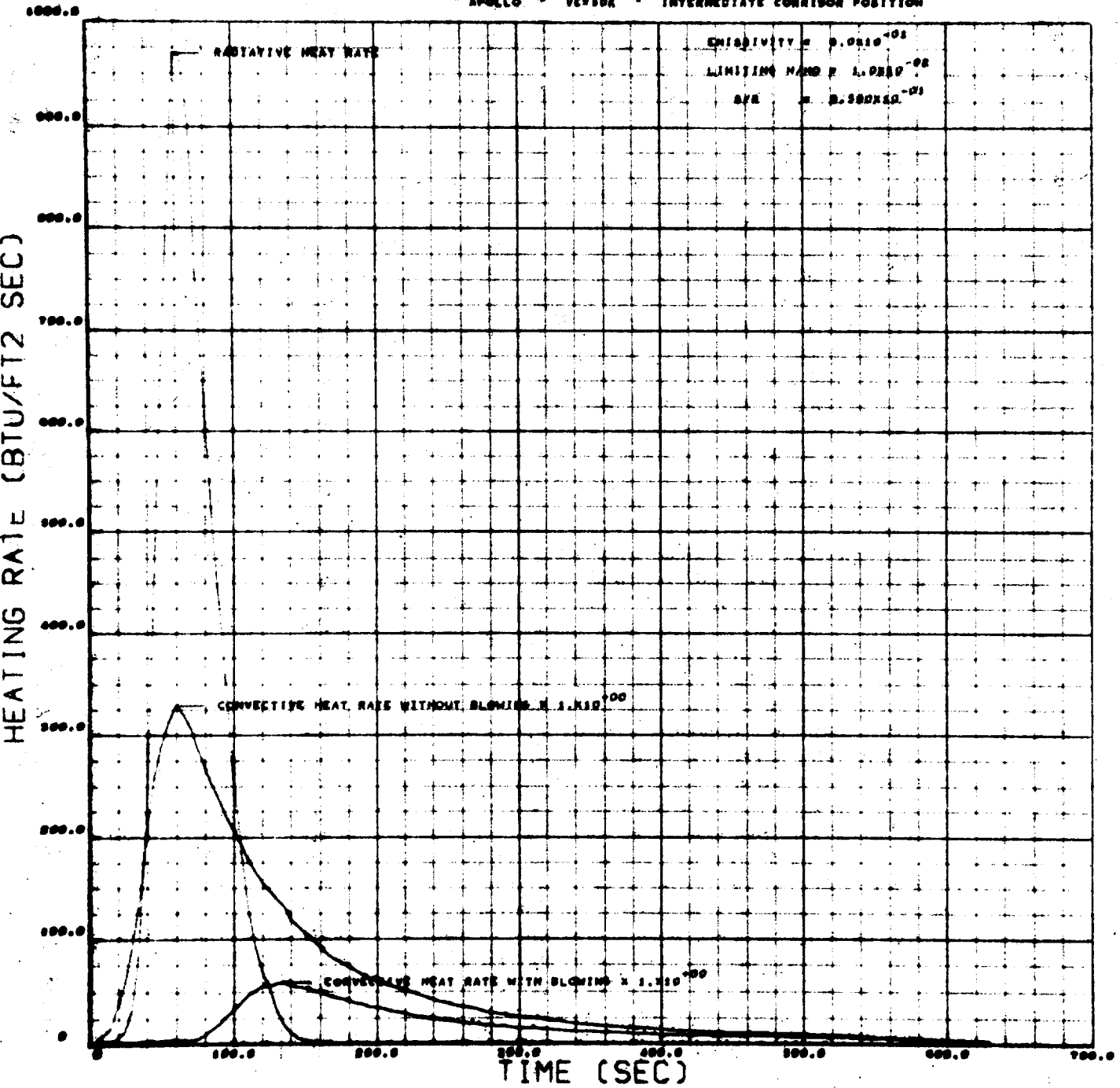


FIGURE A 44

HEATING RATE HISTORY



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FIGURE A 44

MATERIAL RESPONSE DATA

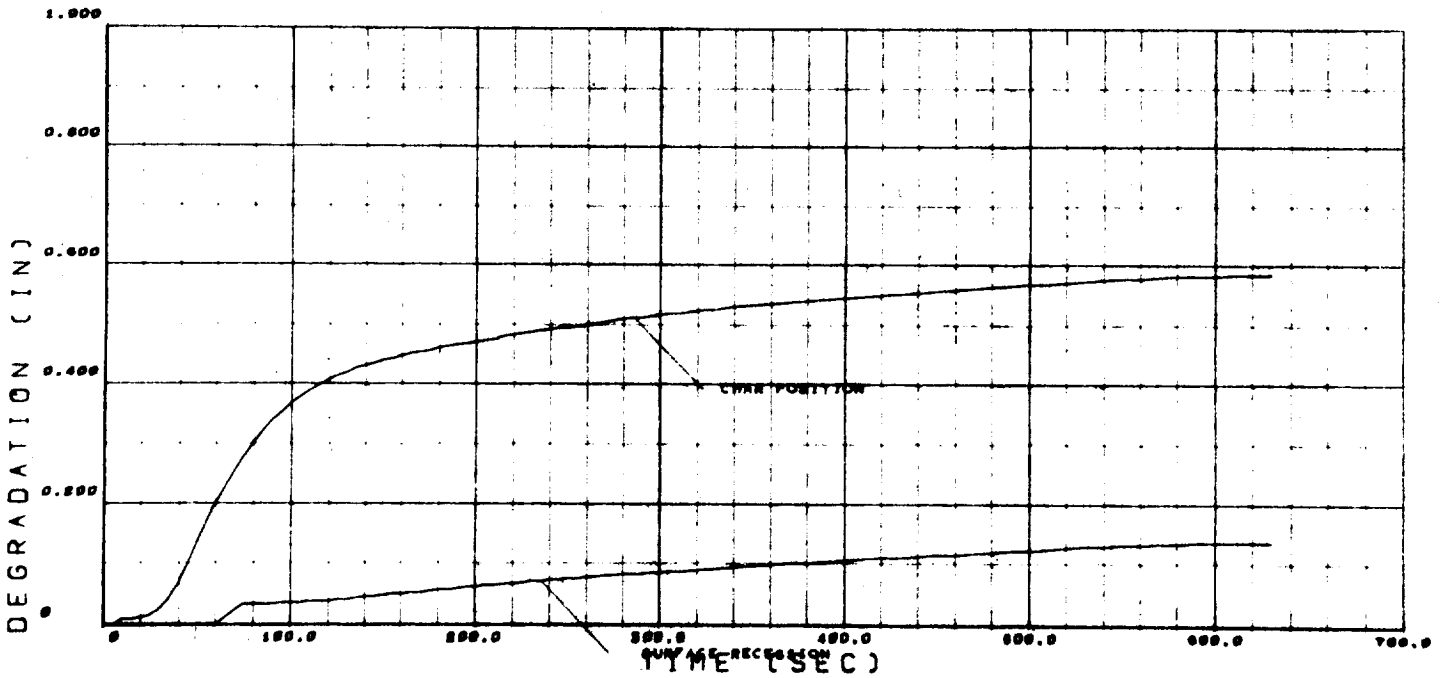
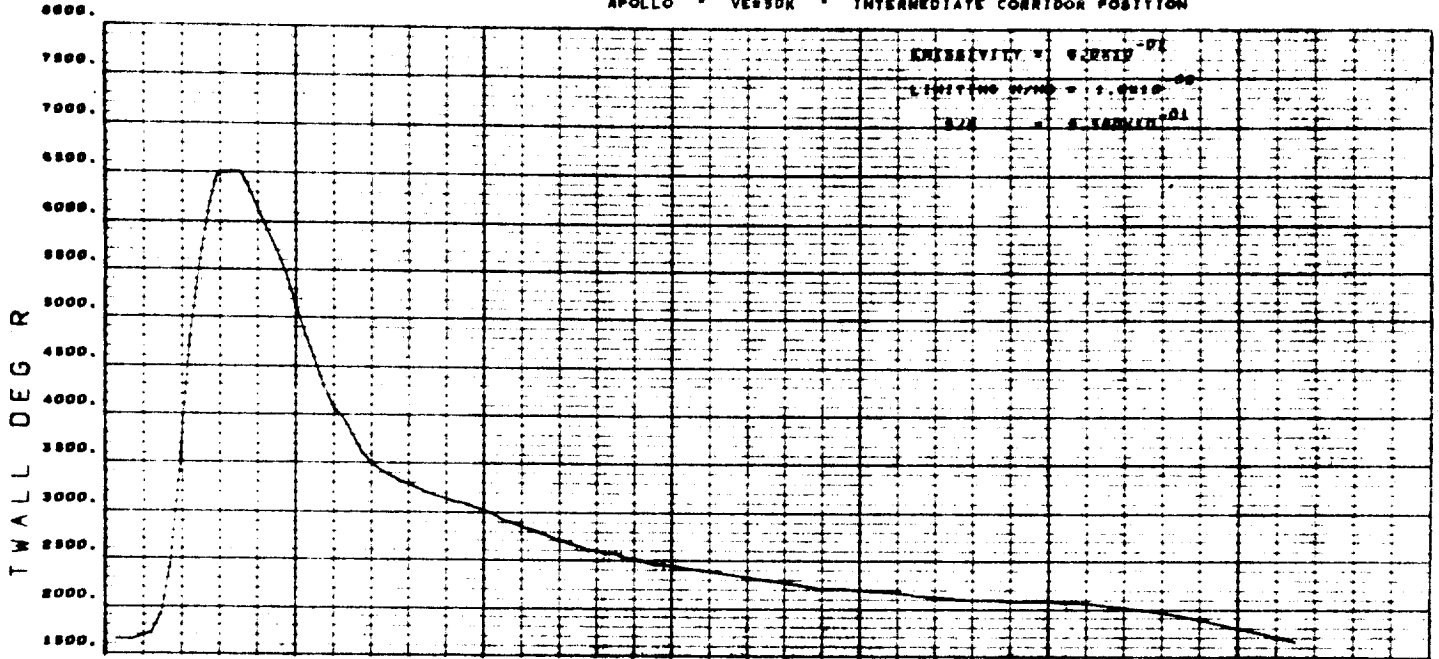


FIGURE A 44

ENERGY ACCOMMODATION MECHANISMS

APOLLO VESSEL INTERMEDIATE CORRIDOR POSITION

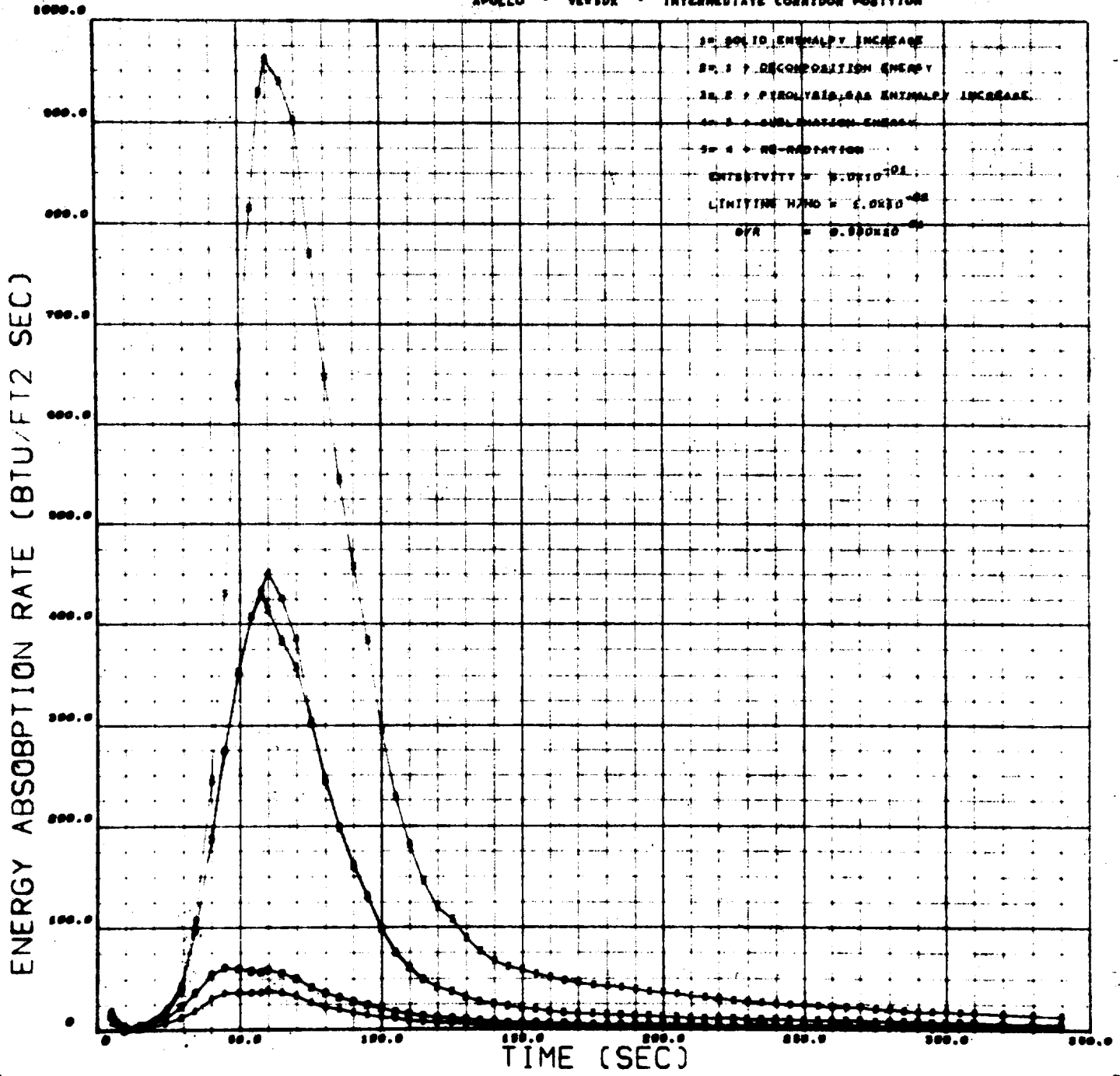


FIGURE A 45

HEATING RATE HISTORY

APOLLO SENSOR INTERMEDIATE CORRIDOR POSITION

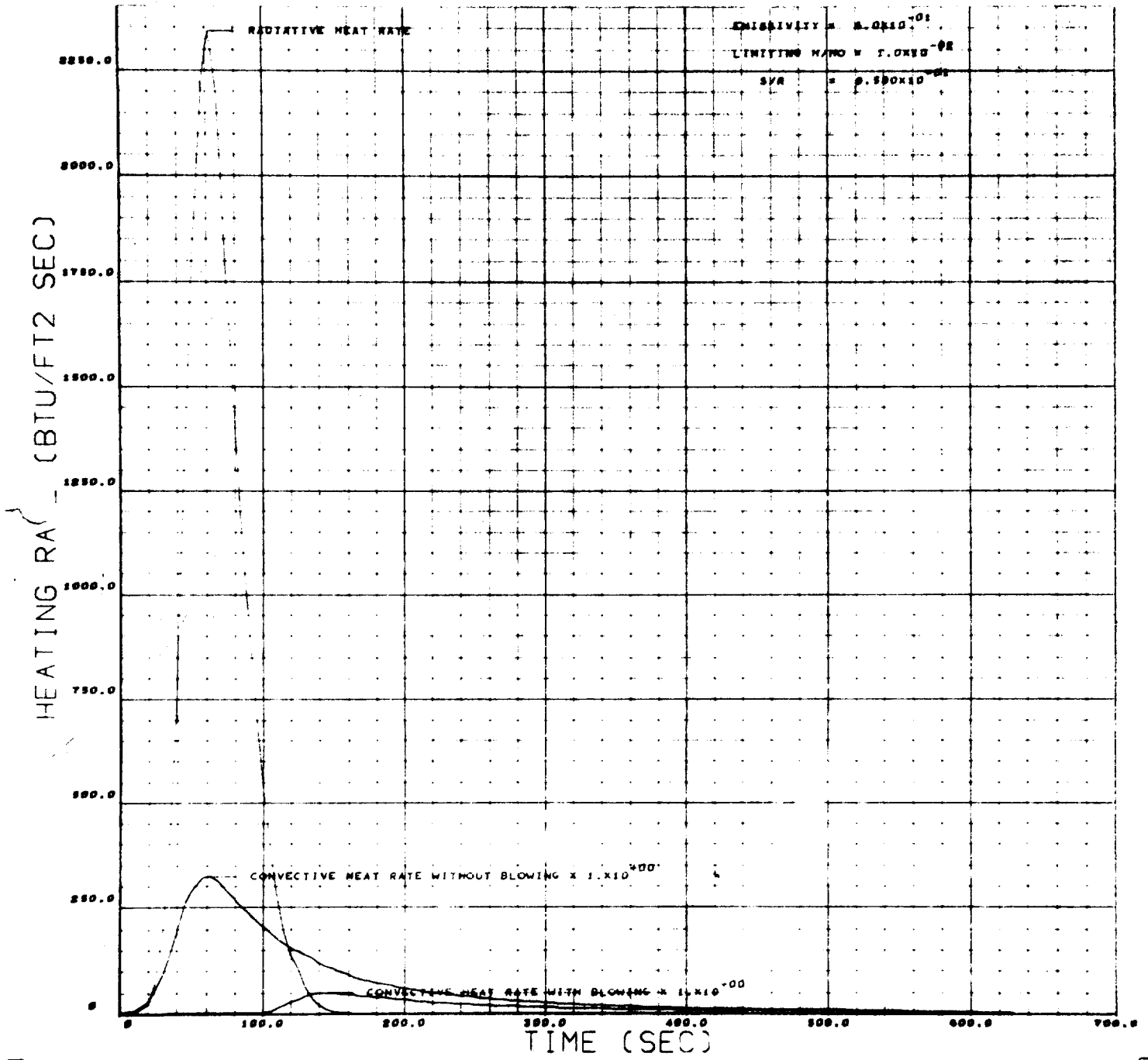


FIGURE A 45

MATERIAL RESPONSE DATA

APOLLO VE-50K INTERMEDIATE CORRIDOR POSITION

SENSITIVITY = 0.0015 DE
LIMITING VALUE = 1.0000 DE
SCALE = 0.000000001

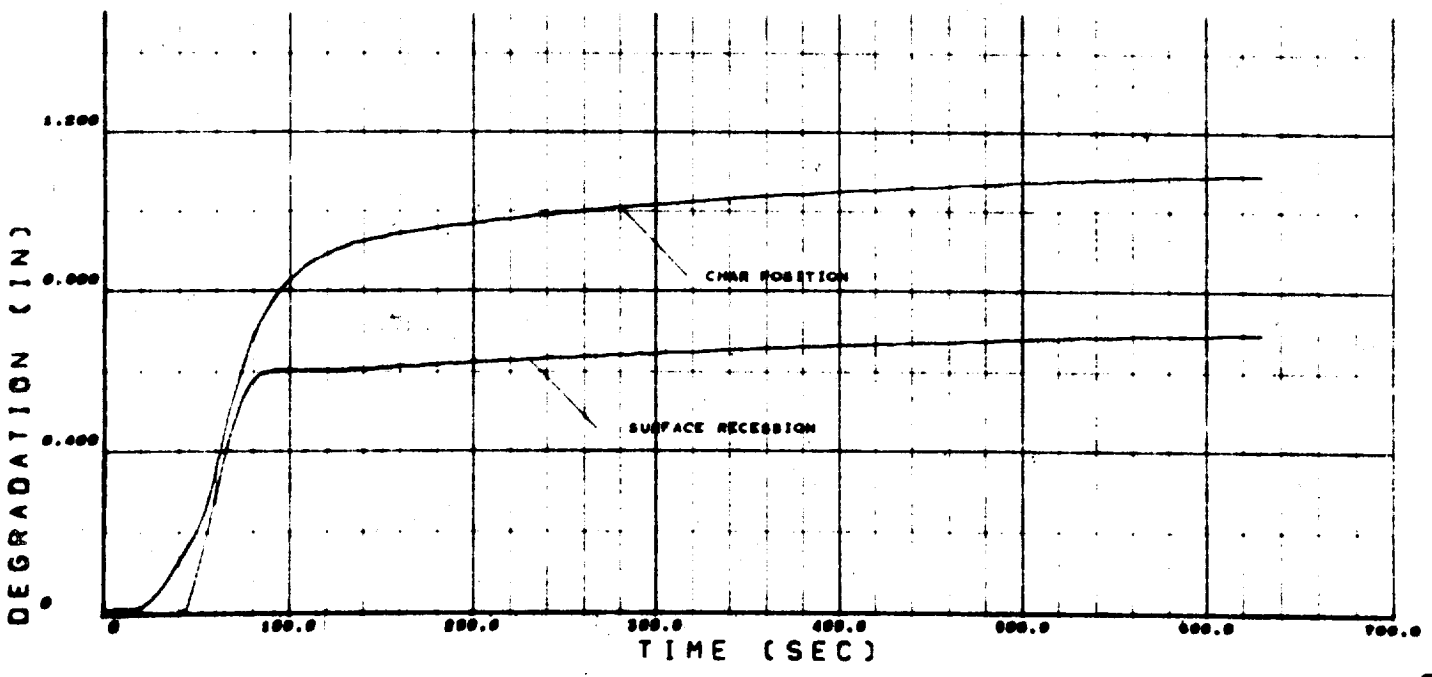
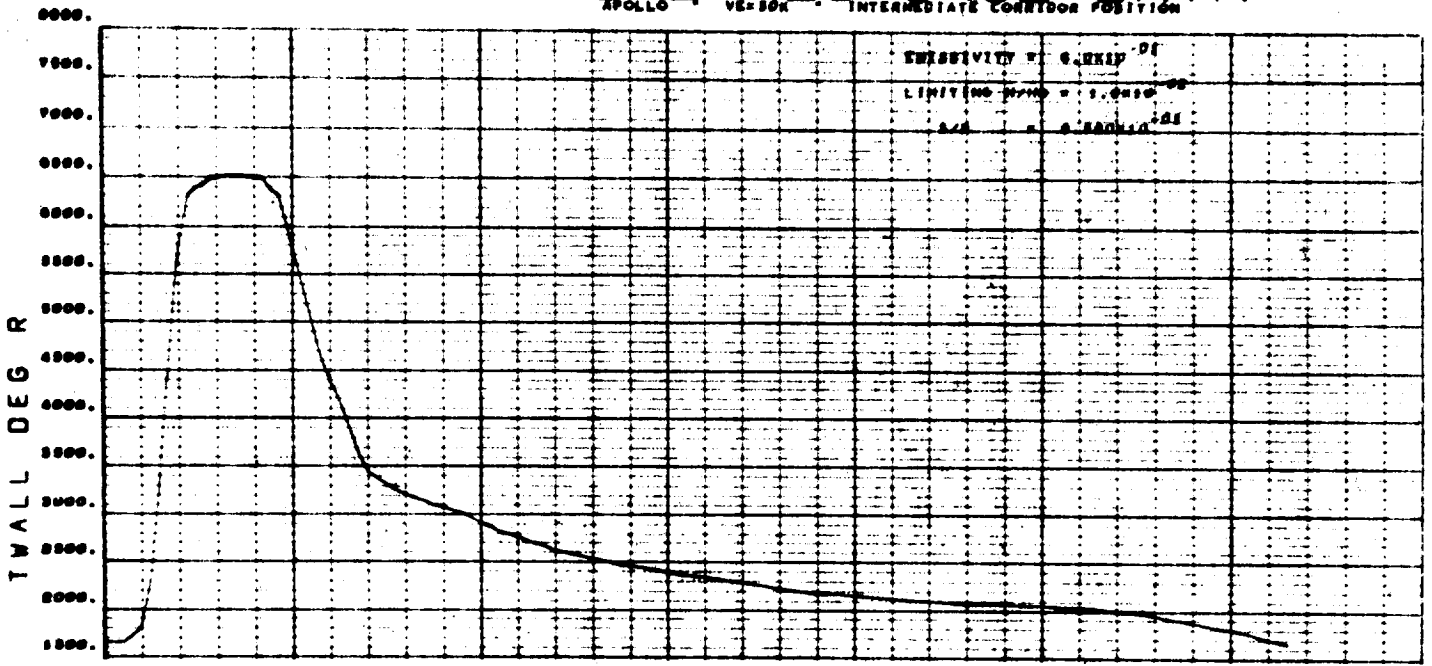


FIGURE A 45

ENERGY ACCOMMODATION MECHANISMS

APOLLO VE=30K INTERMEDIATE CORRIDOR POSITION

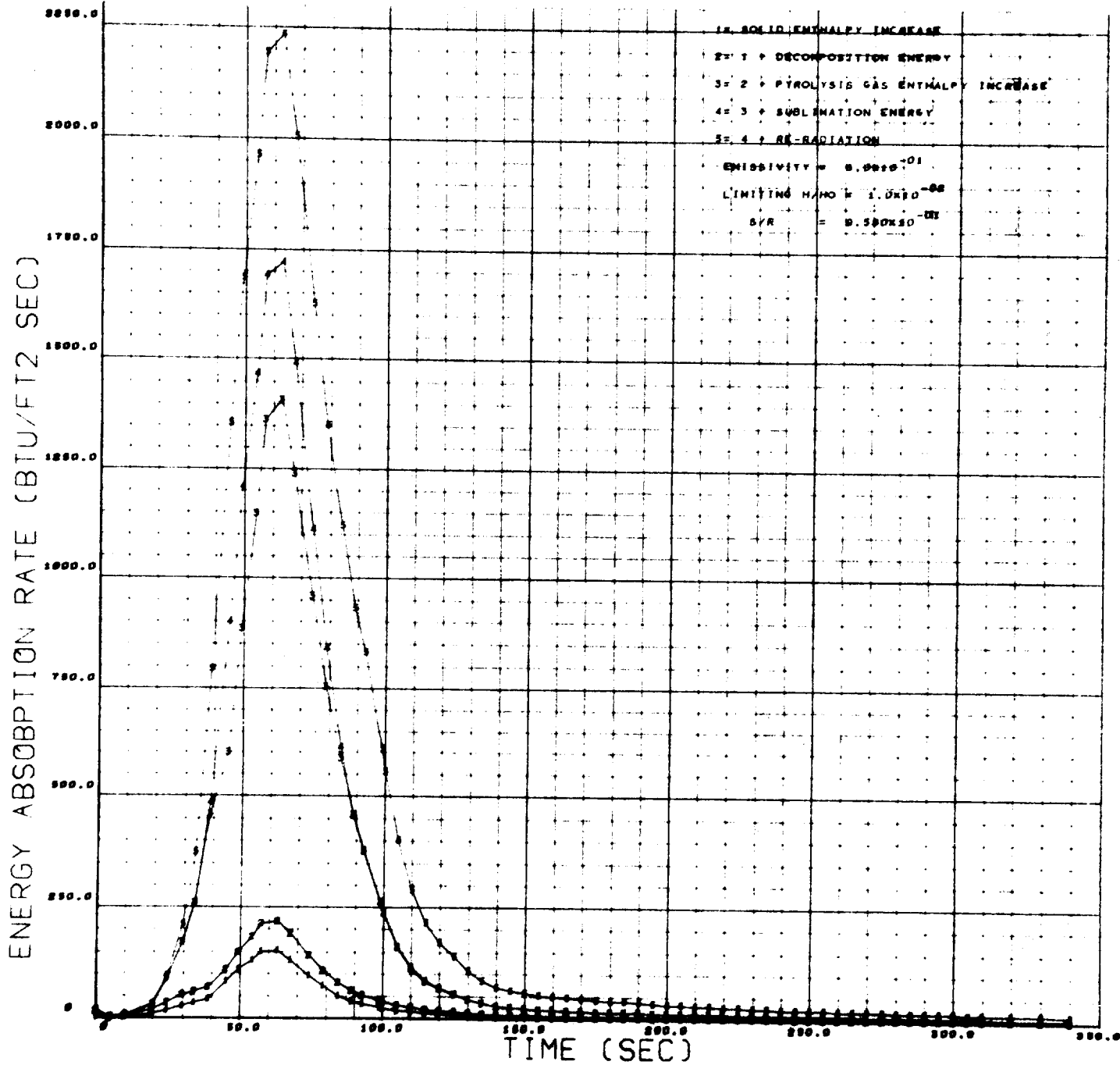


FIGURE 19 46

HEATING RATE HISTORY

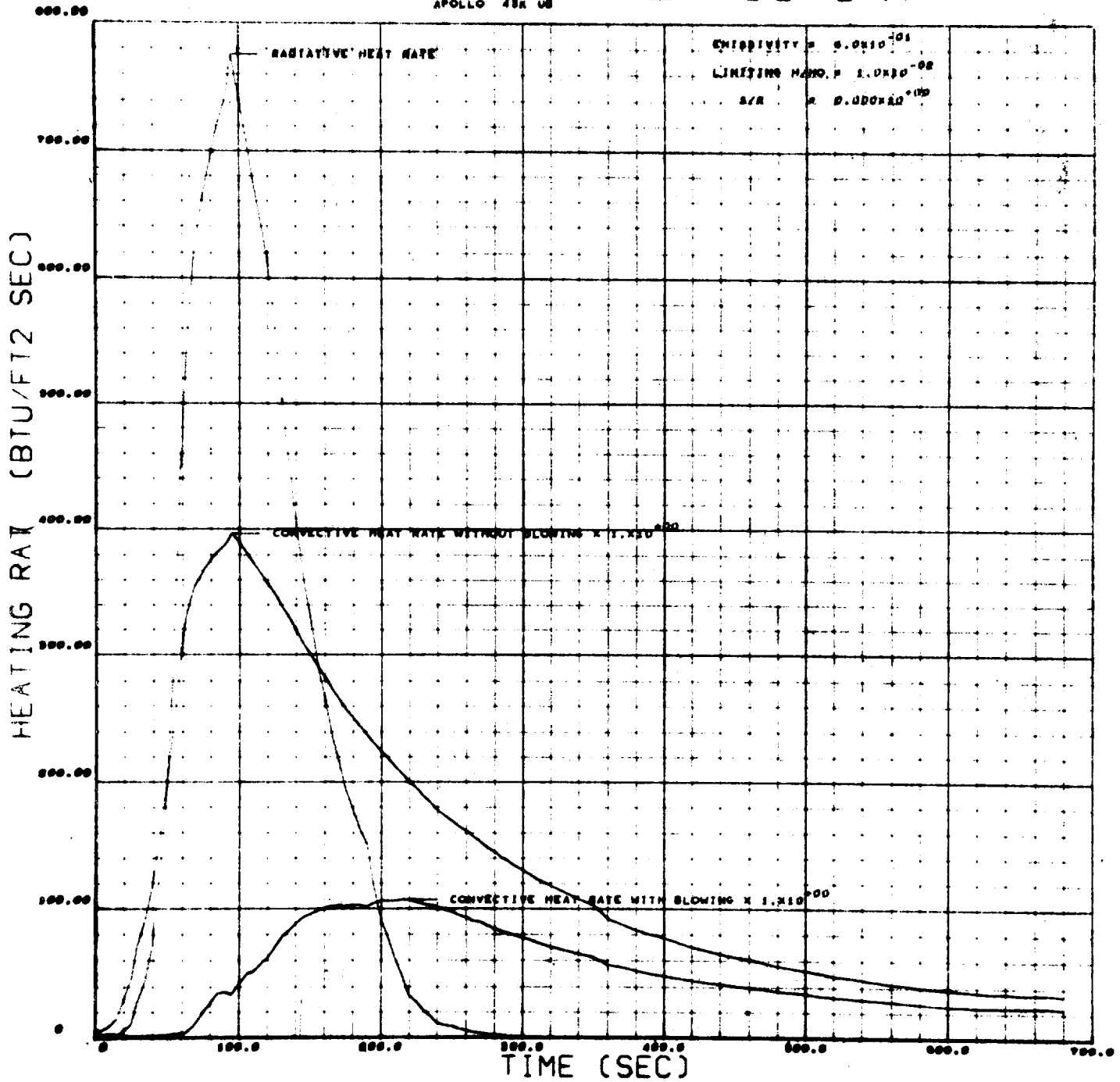


FIGURE A 46

MATERIAL RESPONSE DATA

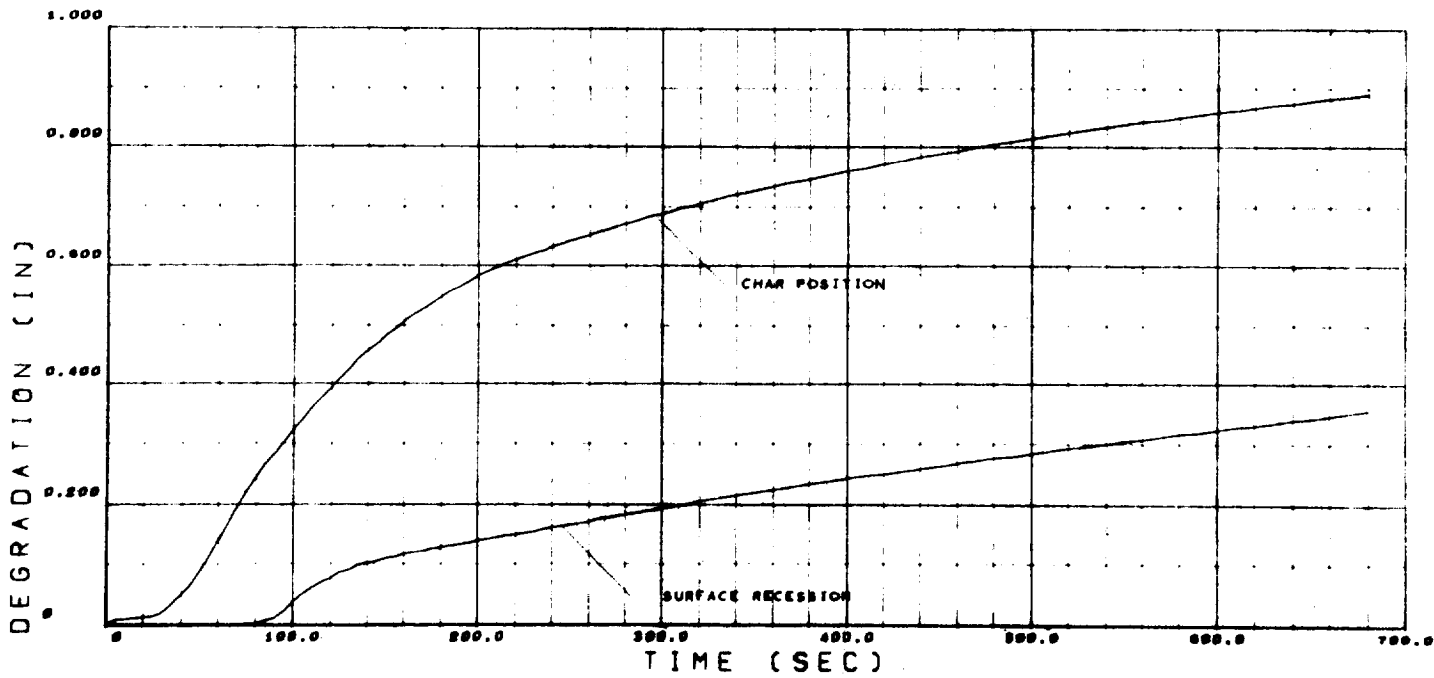
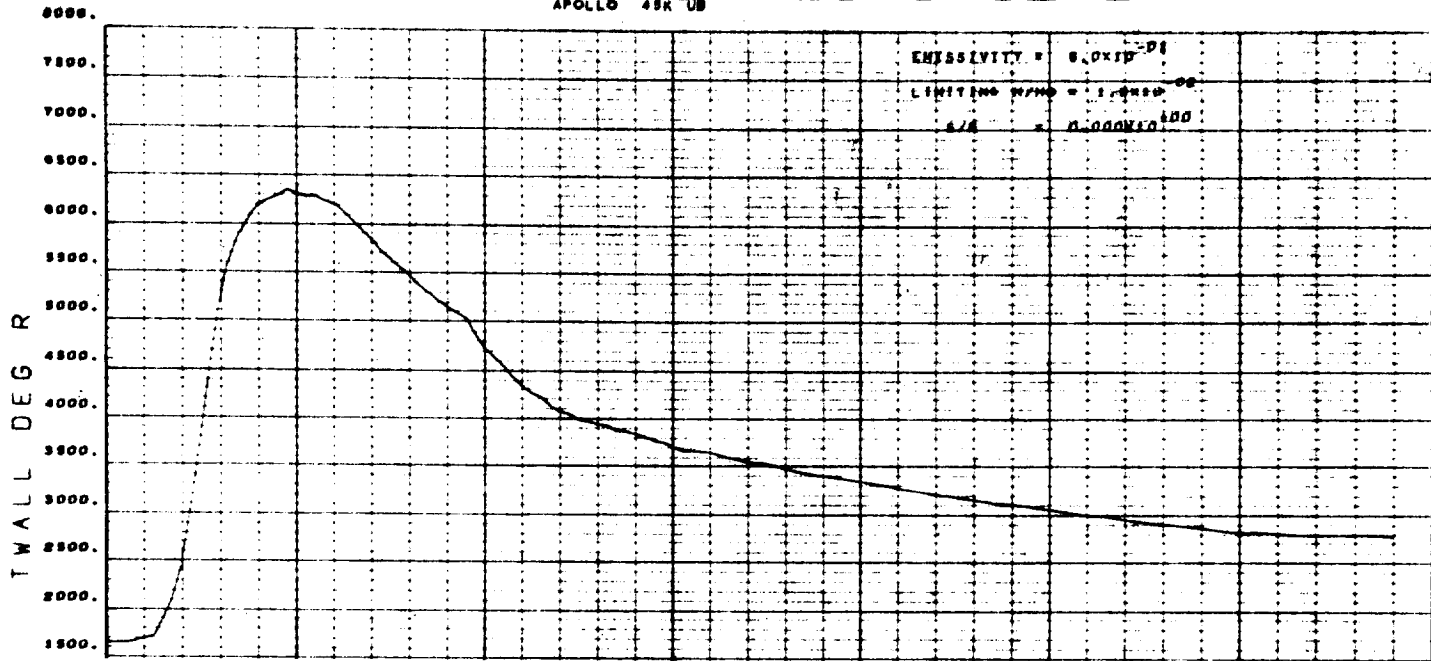


FIGURE A 46

ENERGY ACCOMMODATION MECHANISMS

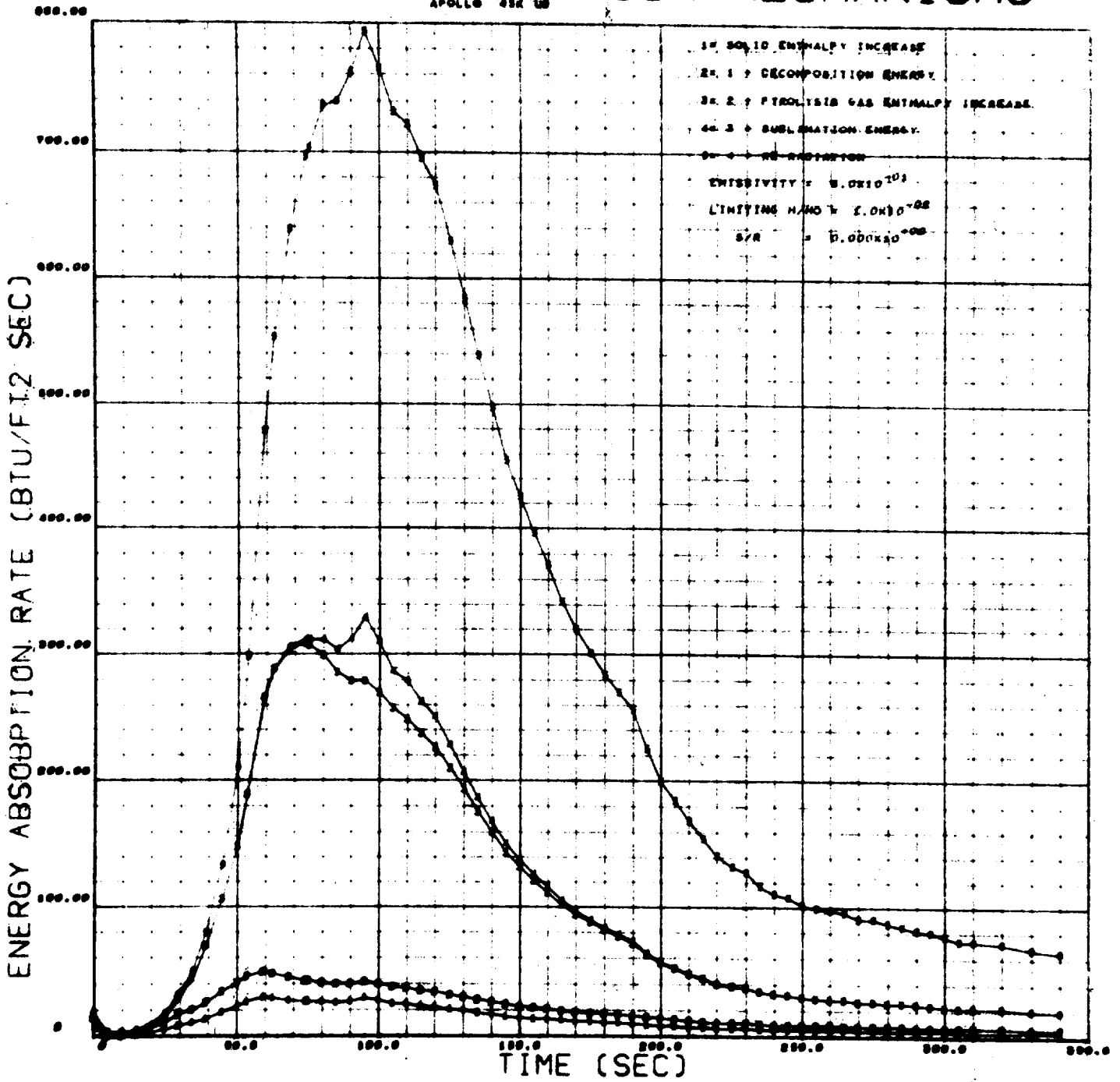


FIGURE A 47

HEATING RATE HISTORY

APOLLO 7TK US

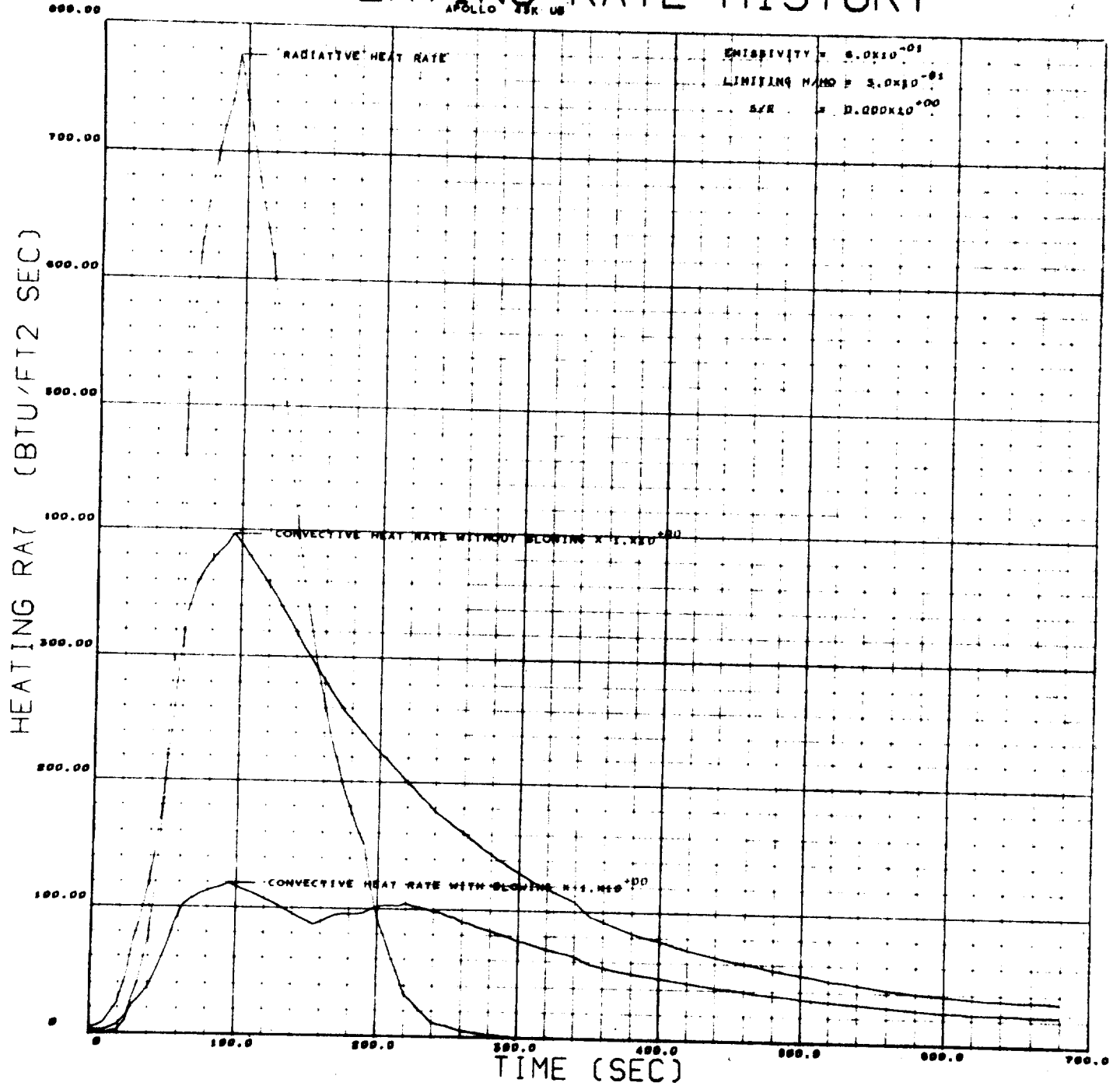


FIGURE A 47

MATERIAL RESPONSE DATA

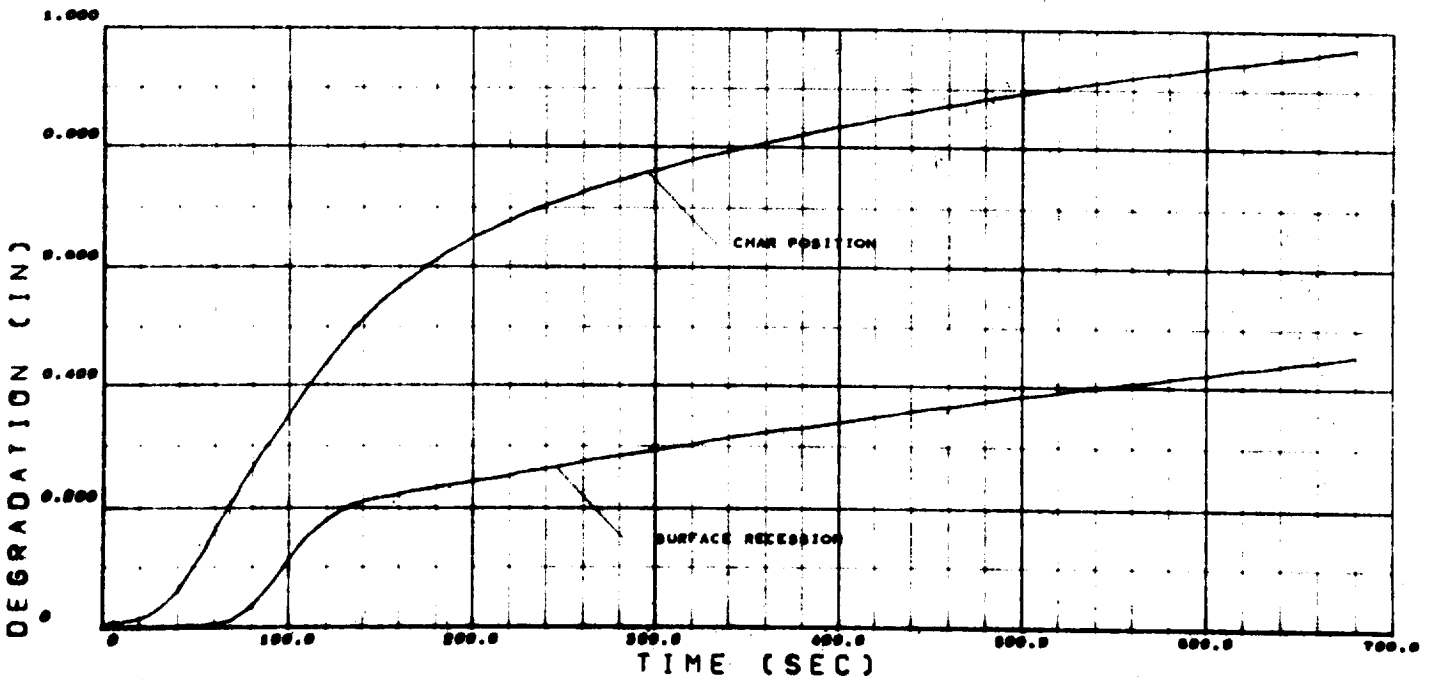
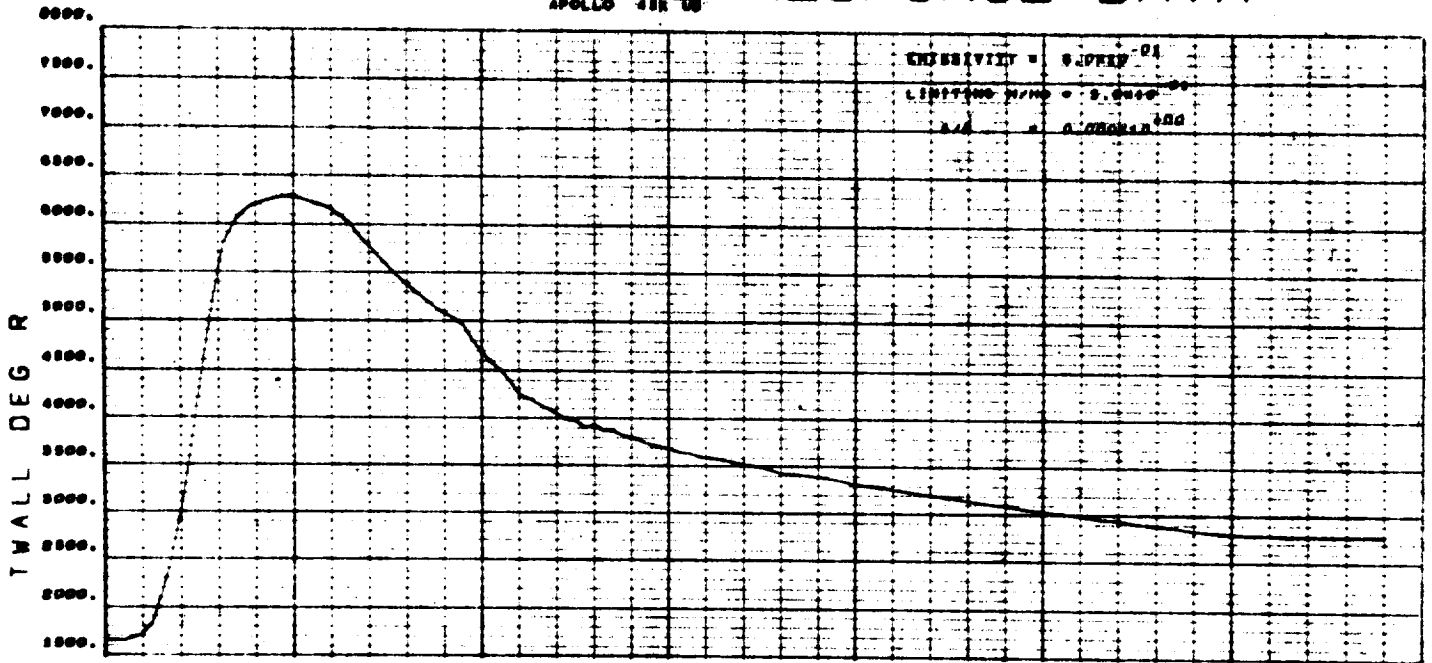


FIGURE A 47

ENERGY ACCOMMODATION MECHANISMS

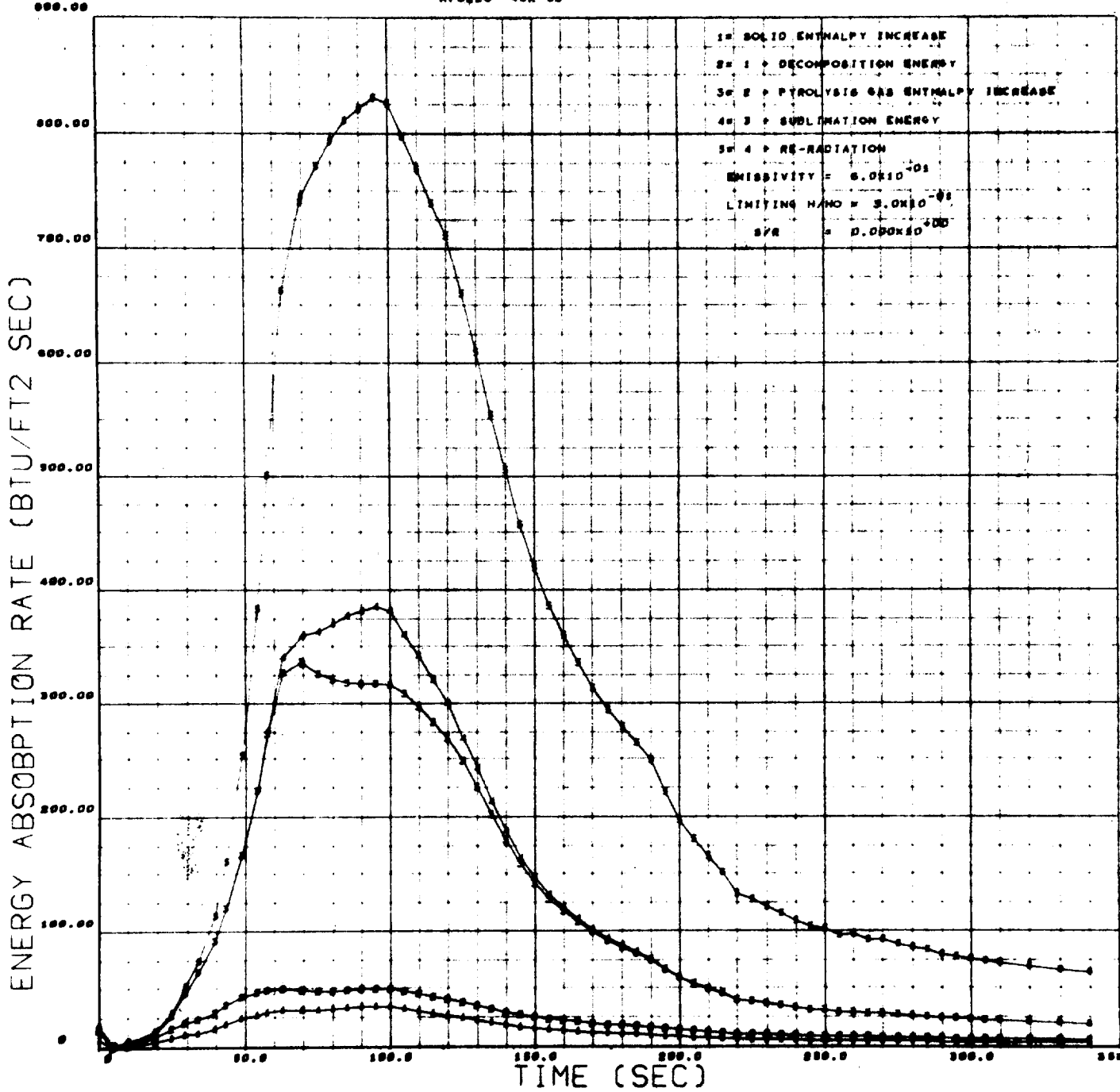


FIGURE A 48

HEATING RATE HISTORY

APOLLO 15R LB

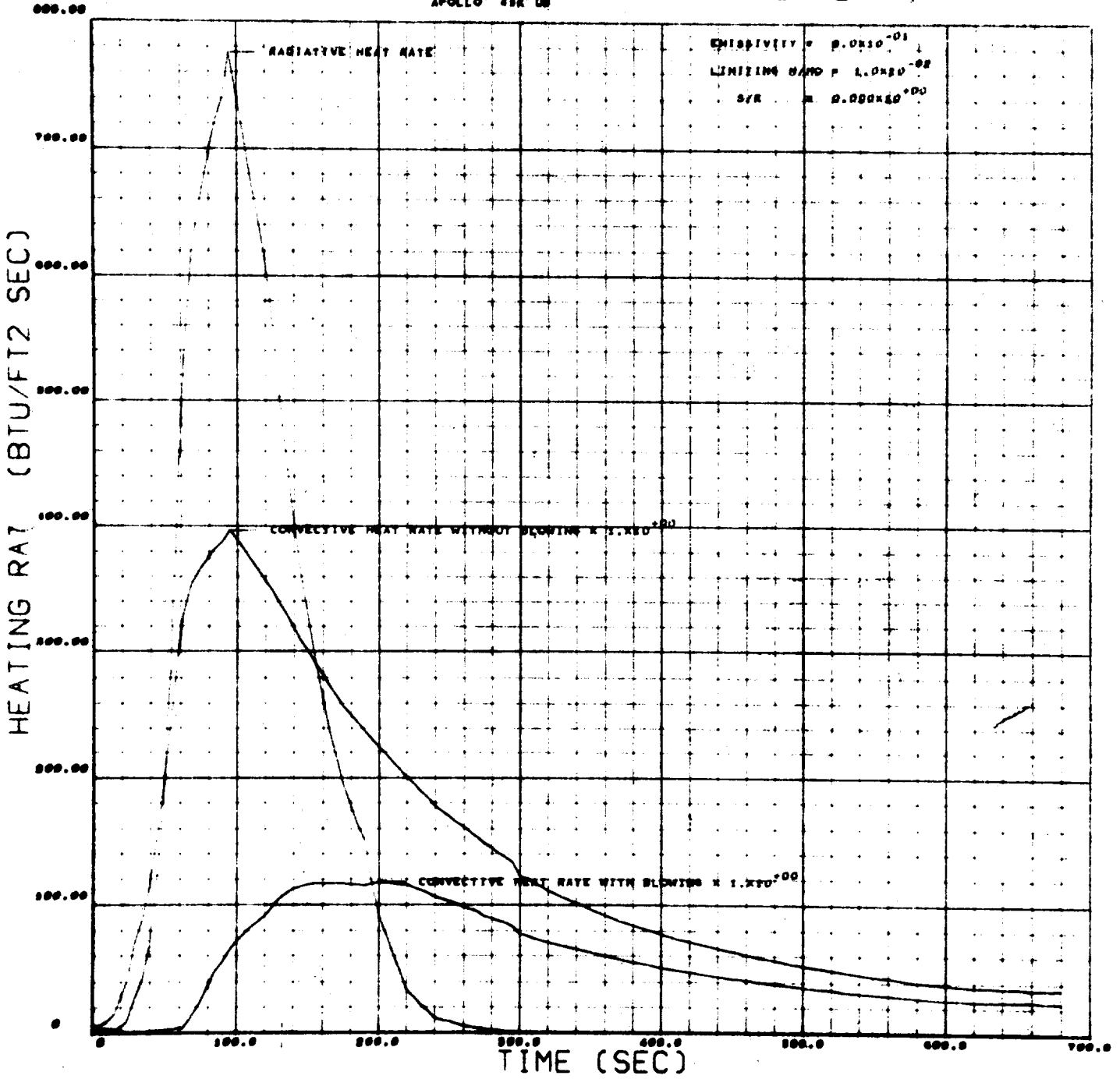


FIGURE A48

MATERIAL RESPONSE DATA

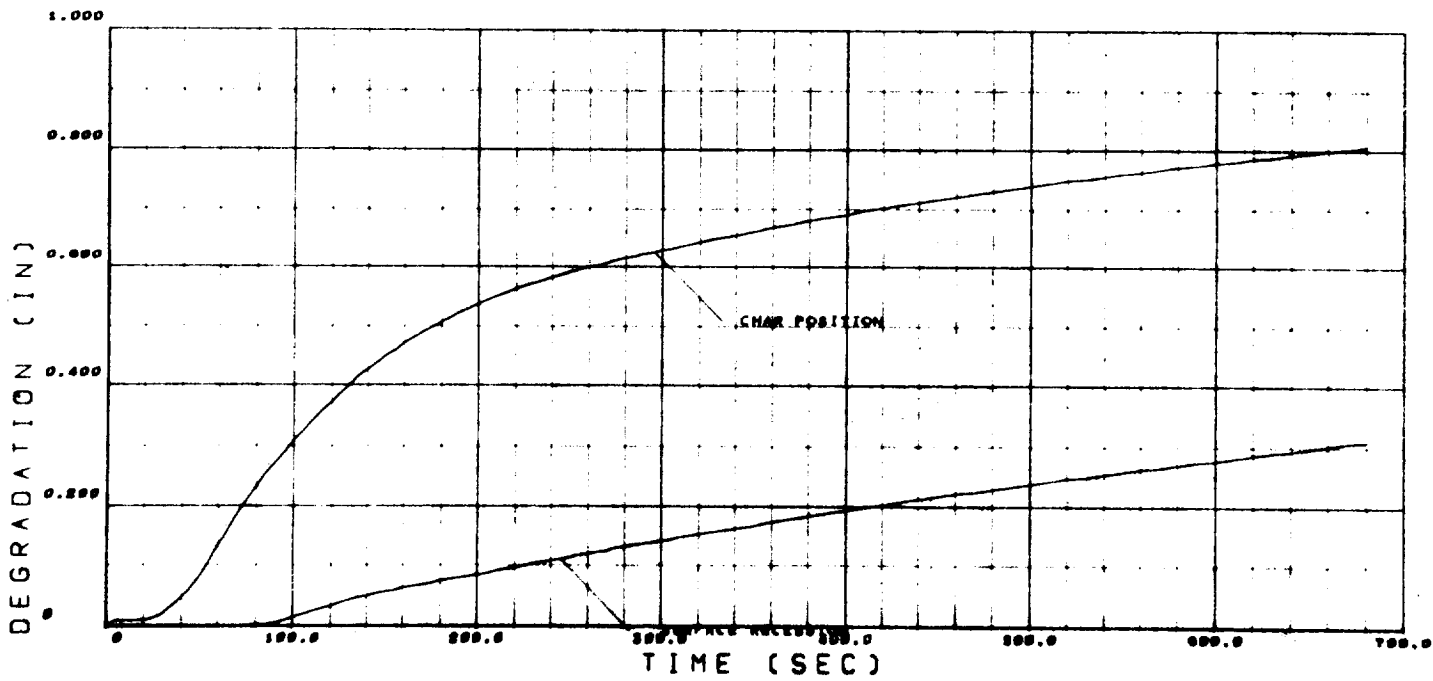
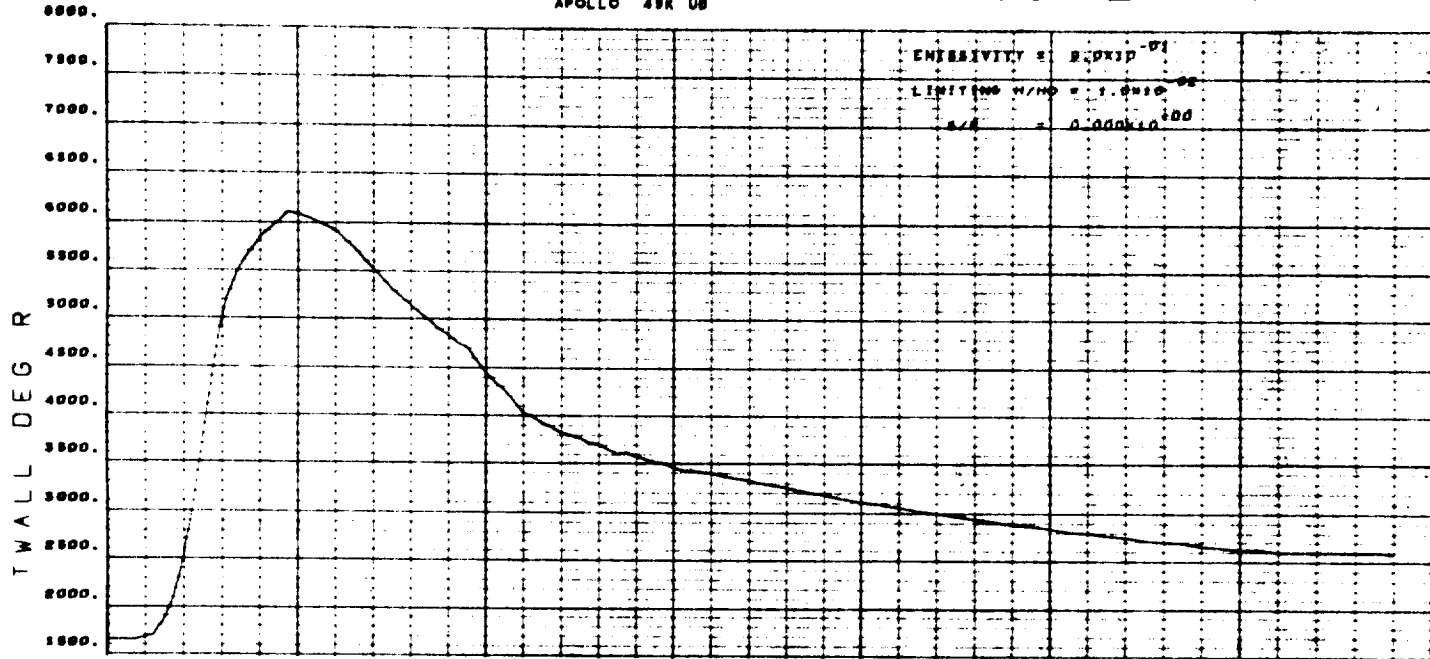


FIGURE A 48

ENERGY ACCOMMODATION MECHANISMS

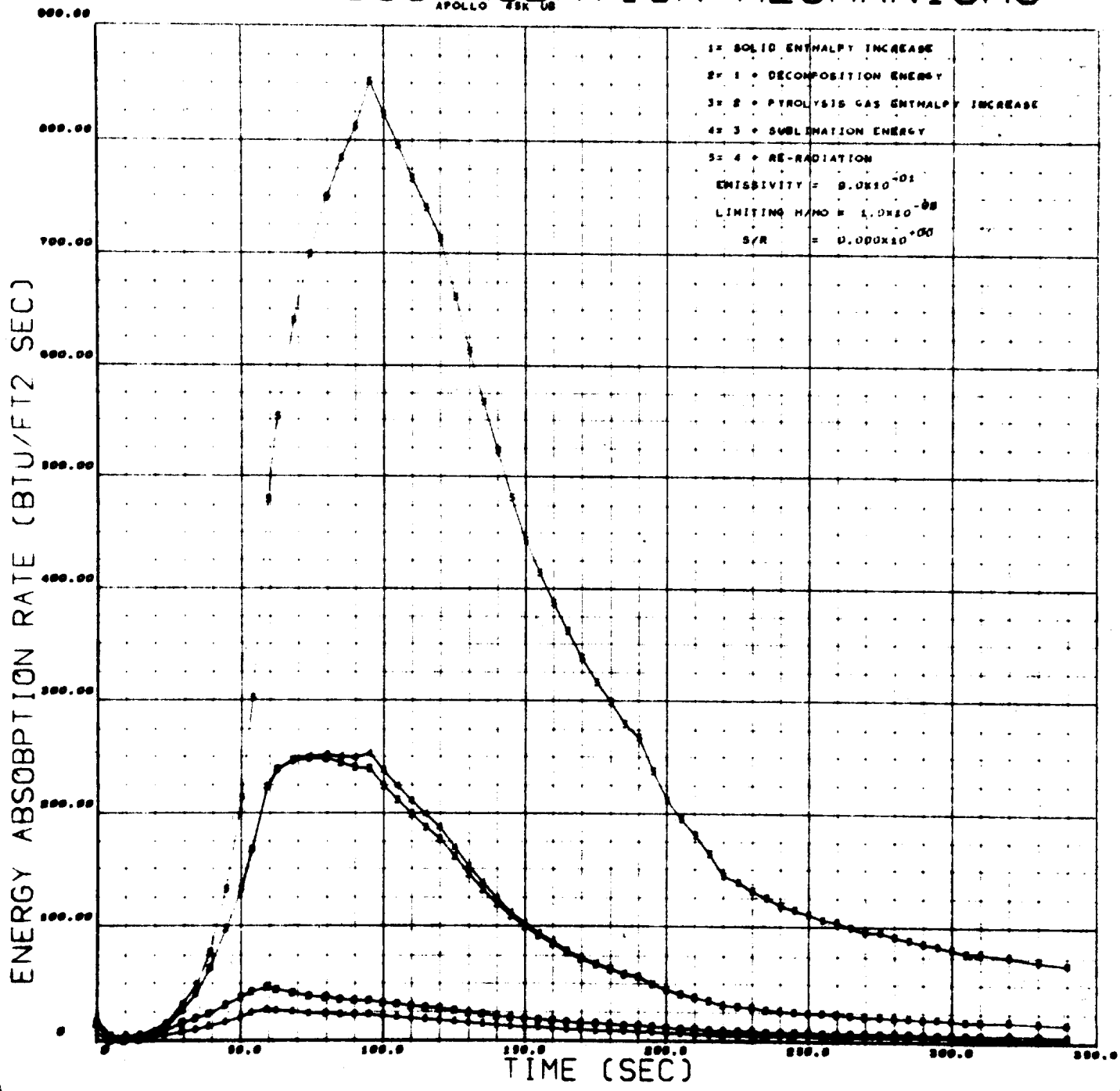


FIGURE A49

HEATING RATE HISTORY

APOLLO 73K UB

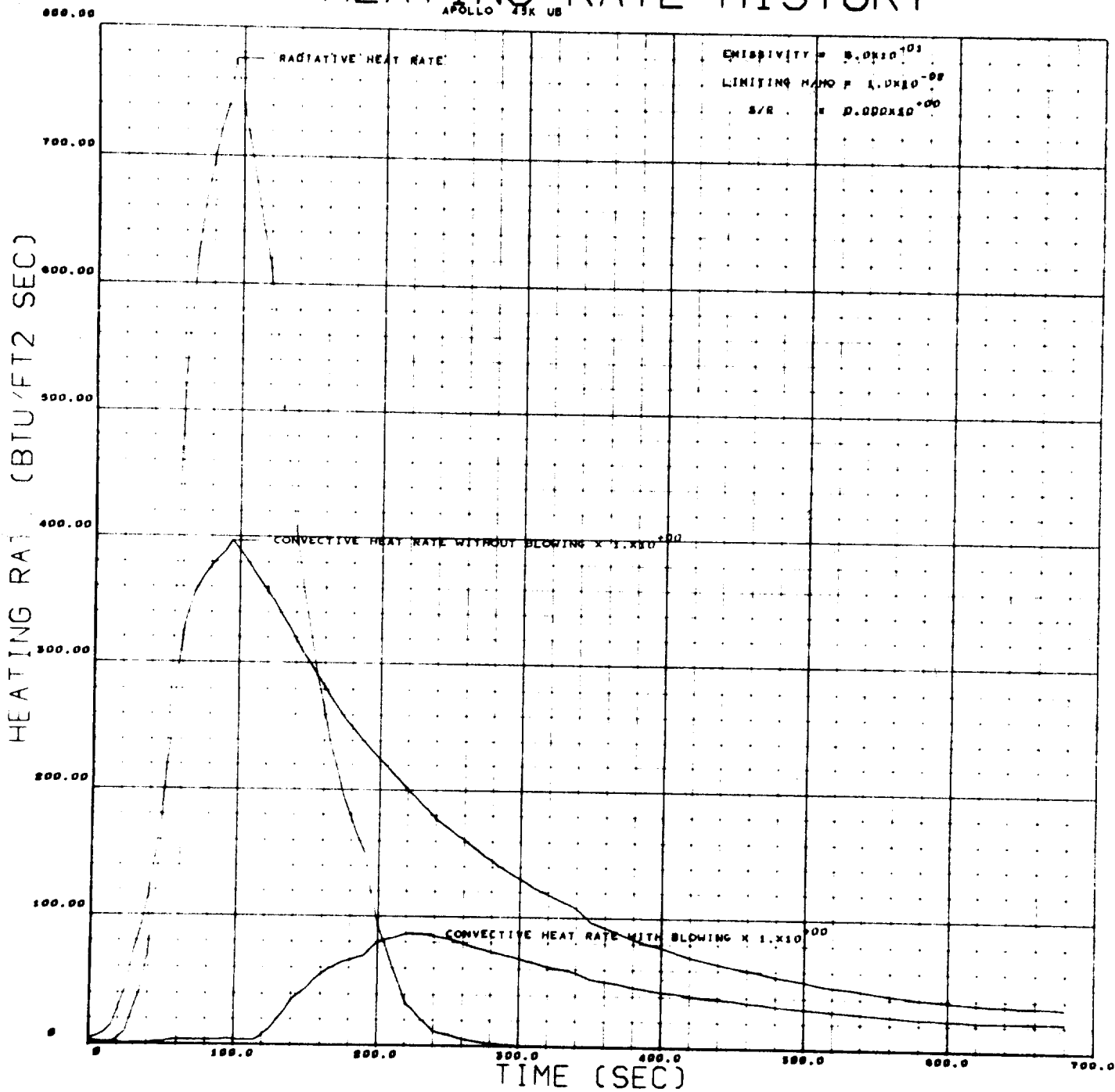


FIGURE A 11

MATERIAL RESPONSE DATA

APOLLO 4SK UB

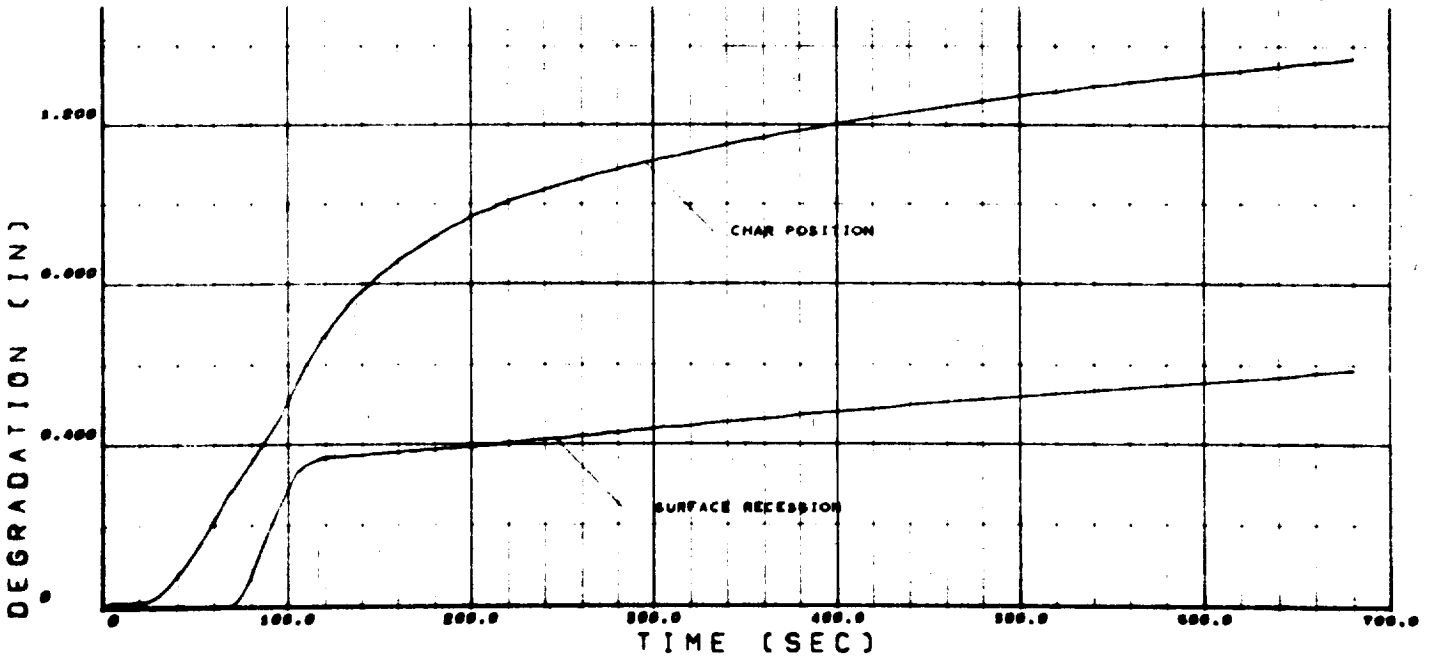
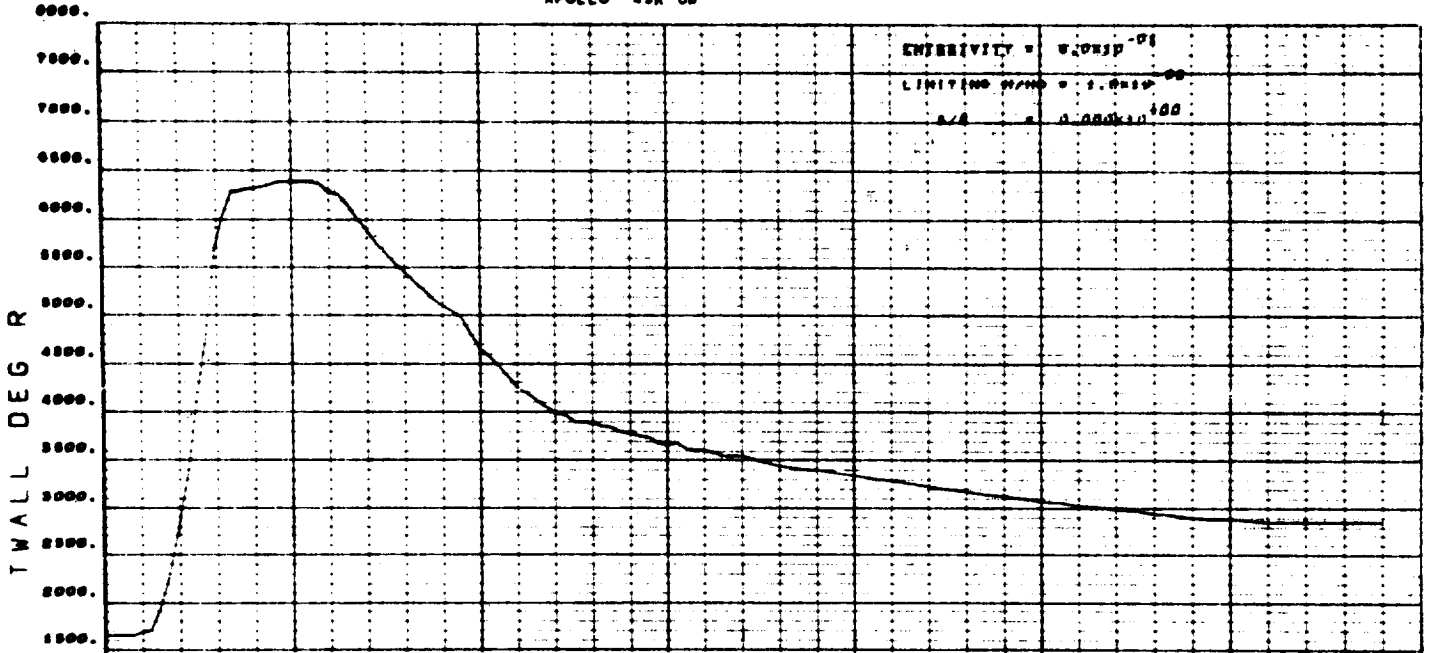


FIGURE A 11

ENERGY ACCOMMODATION MECHANISMS

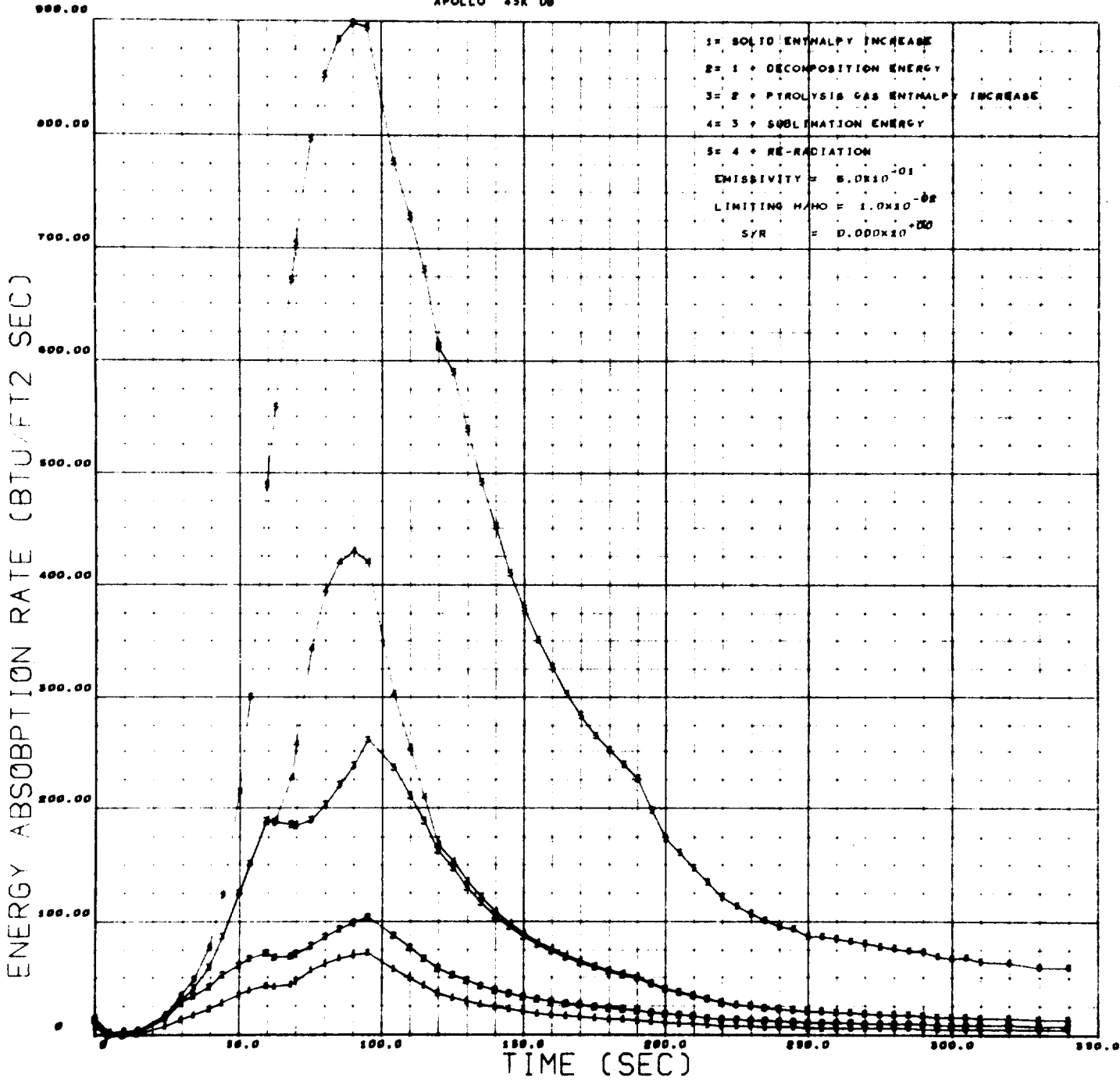


FIGURE A-50

HEATING RATE HISTORY

APOLLO 43K US

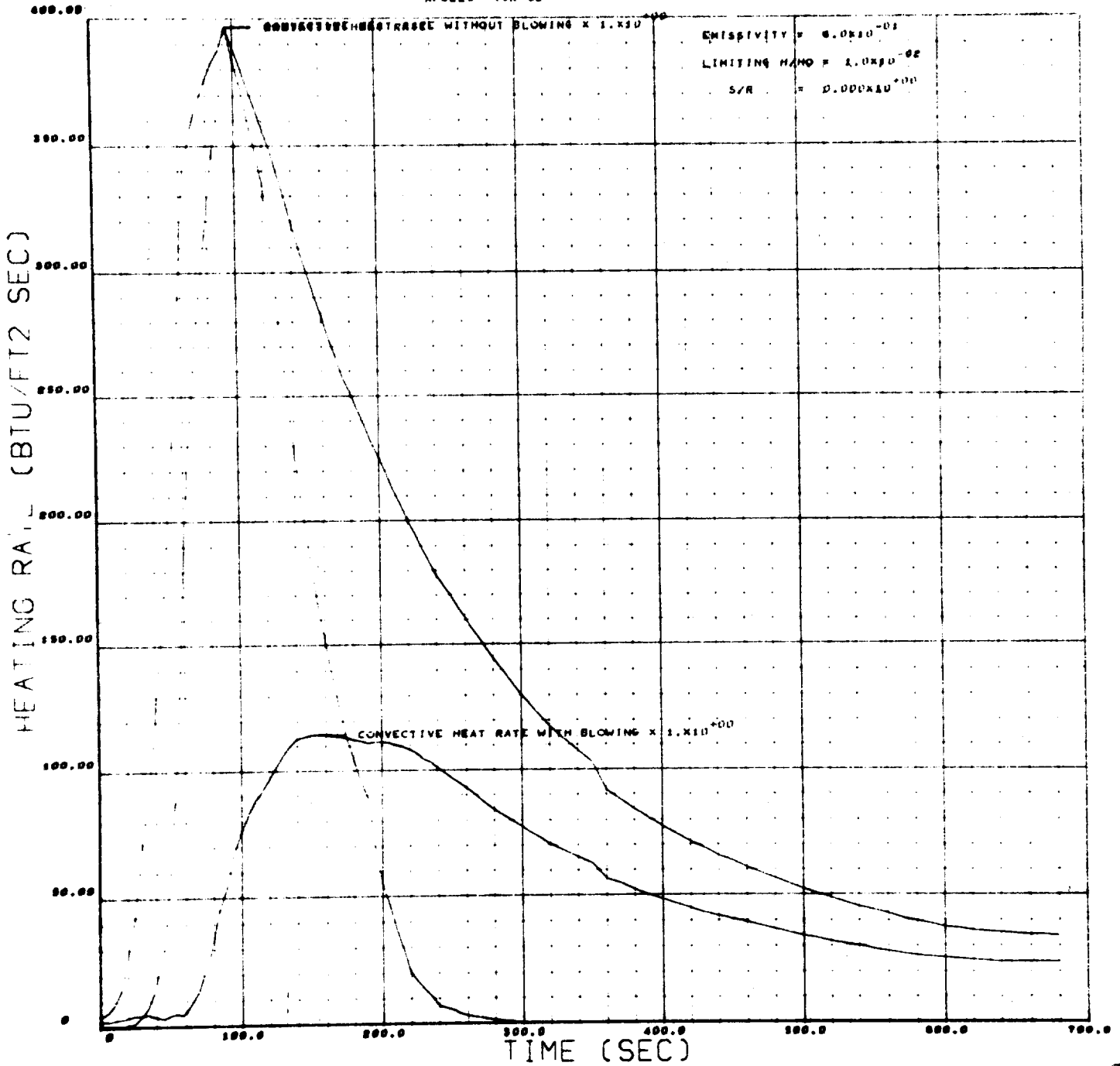


FIGURE A 50

MATERIAL RESPONSE DATA

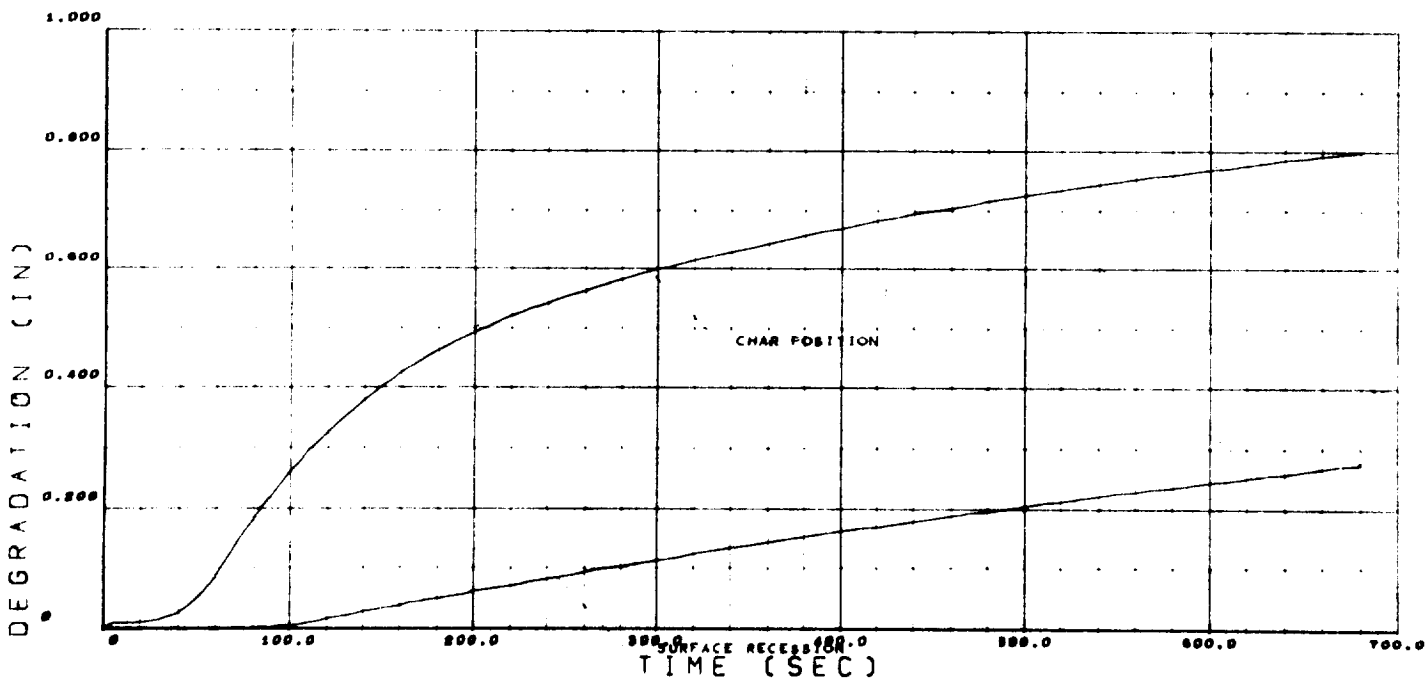
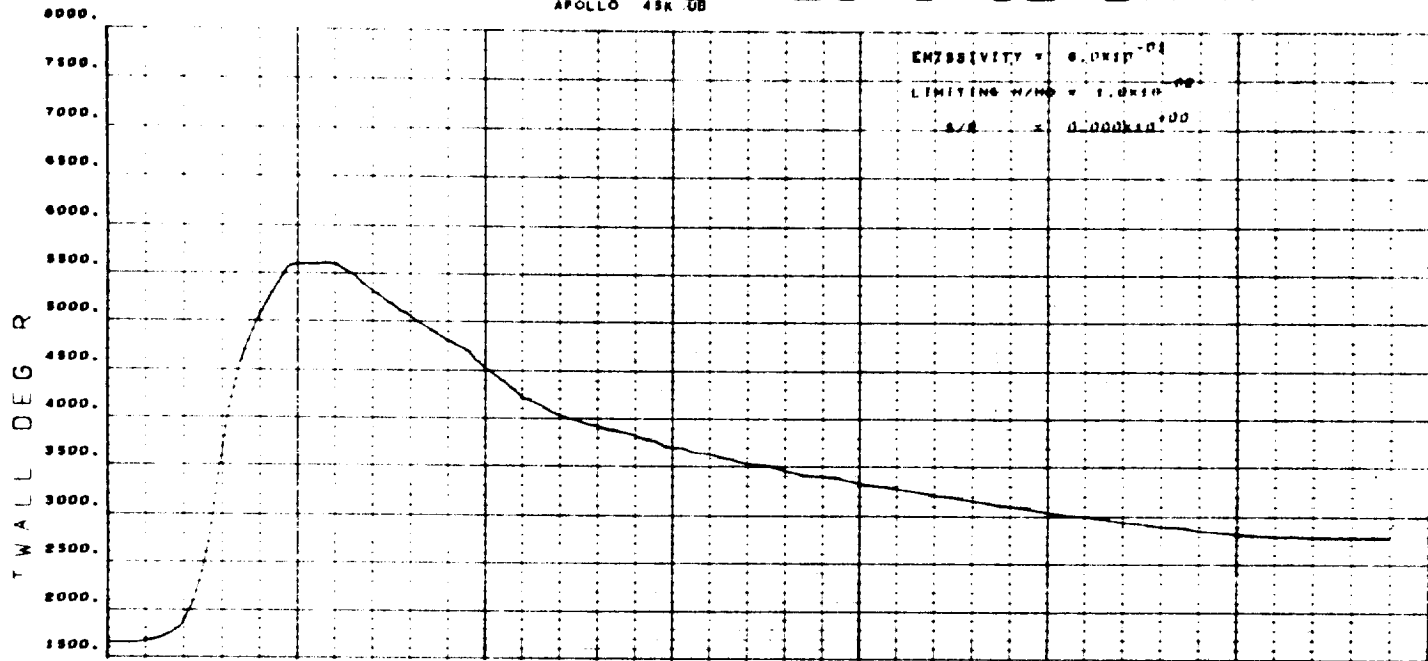


FIGURE A 50

ENERGY ACCOMMODATION MECHANISMS

APOLLO 43K-08

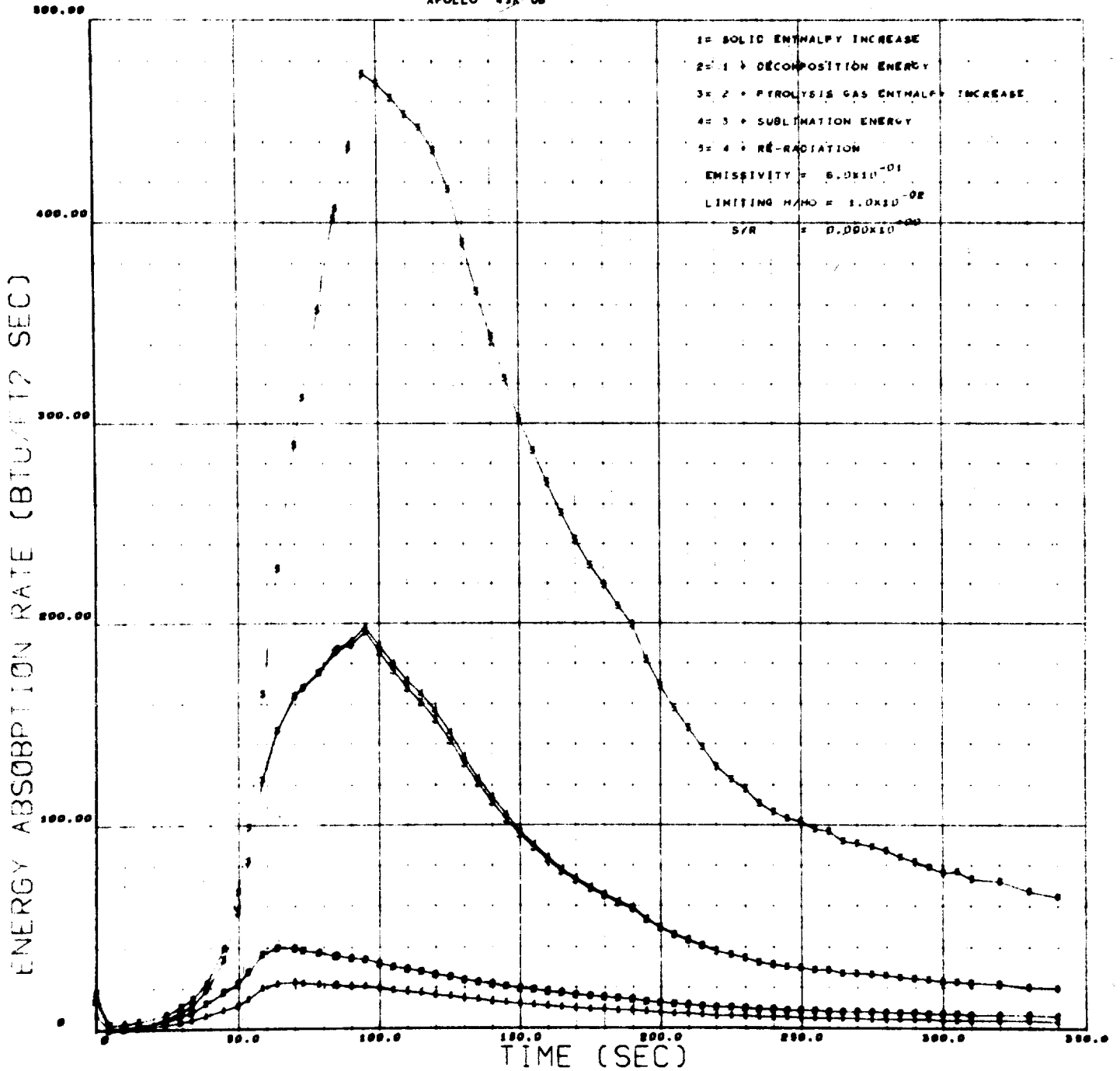


FIGURE A 51

HEATING RATE HISTORY

APOLLO 43K UB

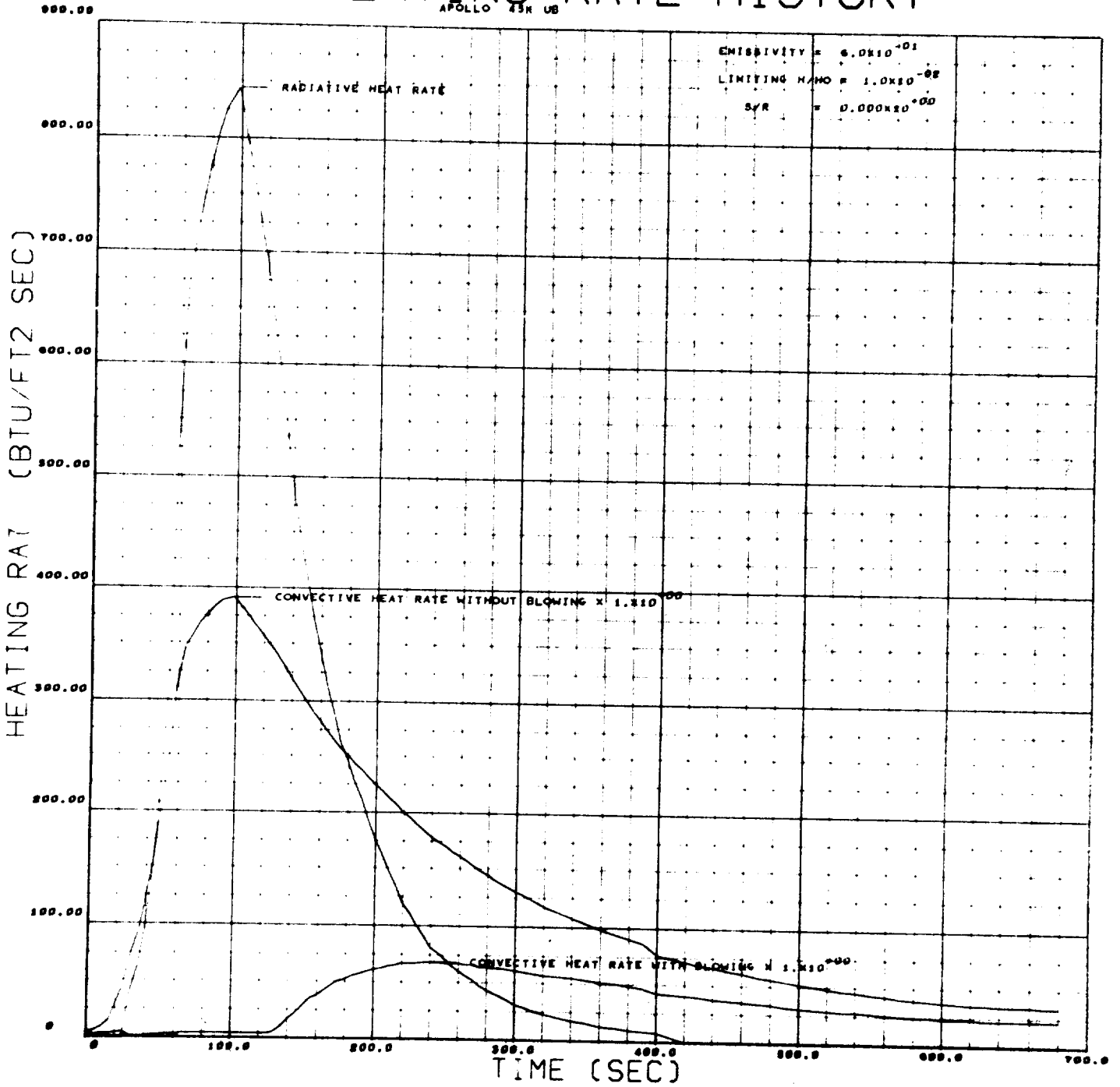


FIGURE A 51

MATERIAL RESPONSE DATA

APOLLO 43R US

EMISSIVITY = 0.0817-01
LIMITING W/FM = 1.0817-00
A/B = 0.00010-00

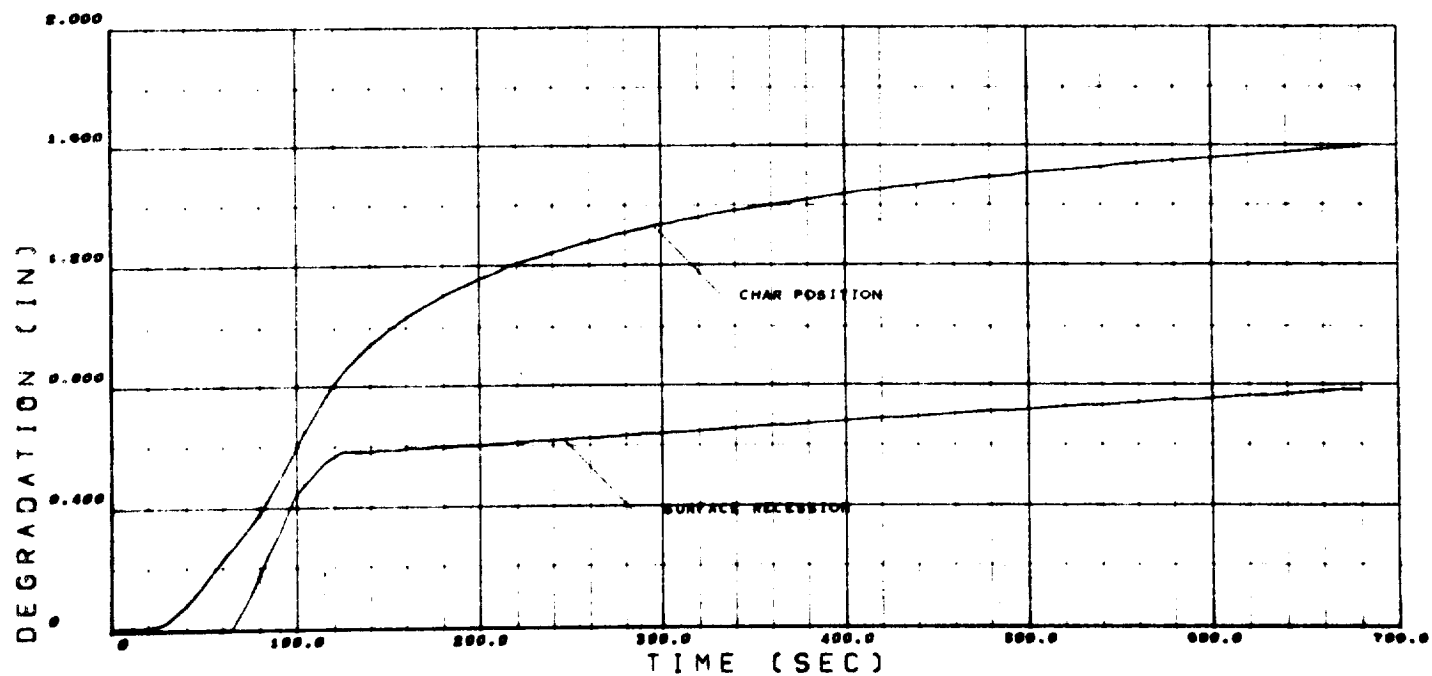
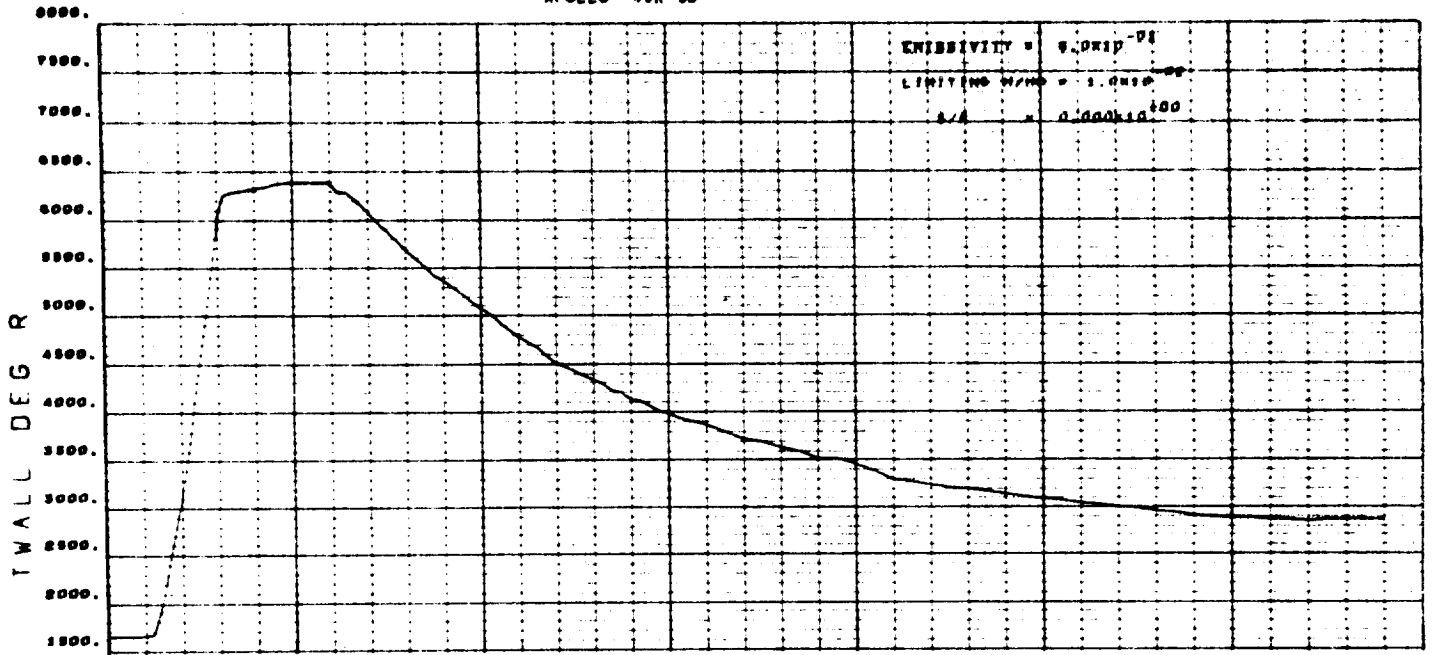


FIGURE A 51

ENERGY ACCOMMODATION MECHANISMS

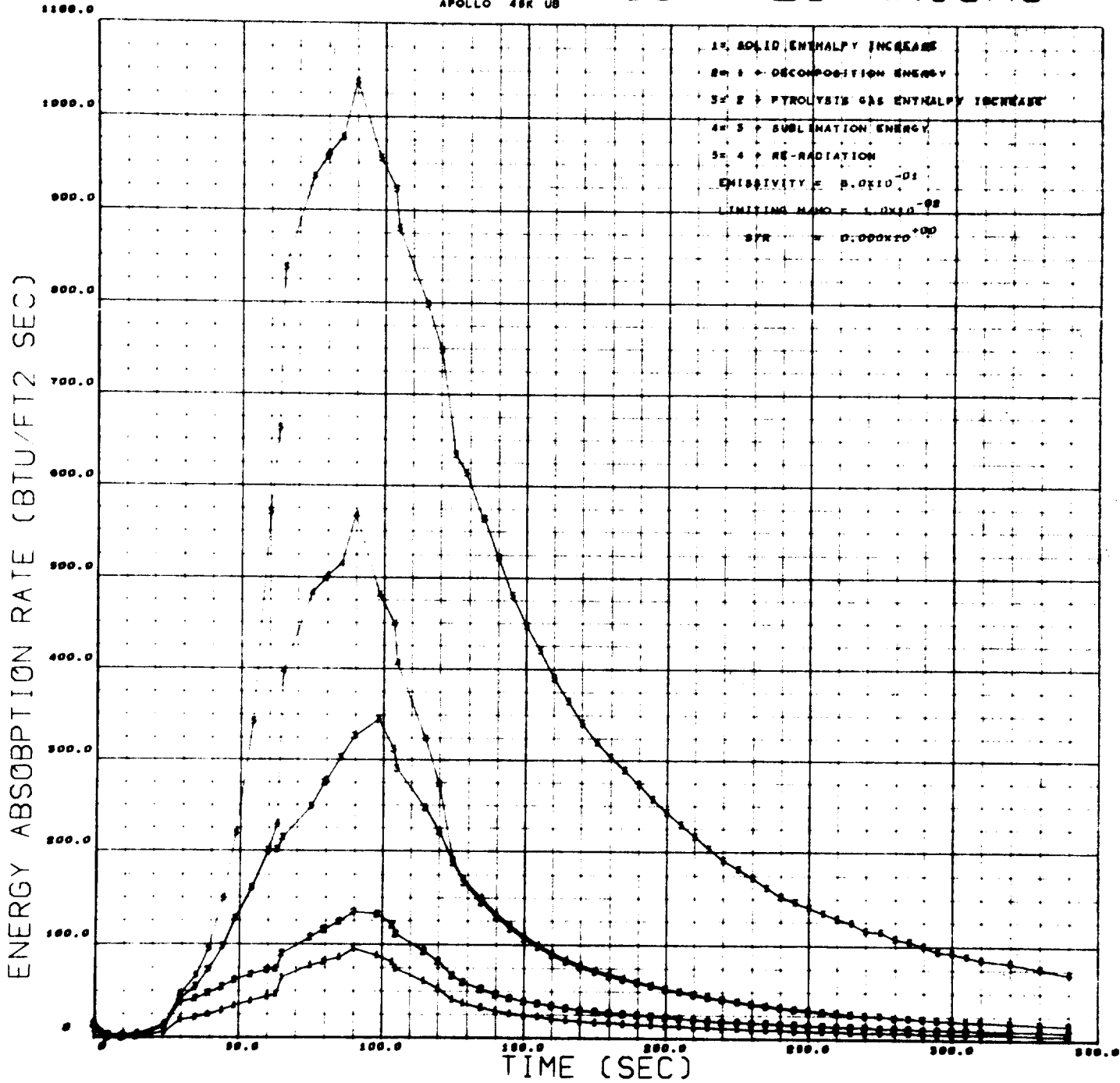


FIGURE A 52

HEATING RATE HISTORY

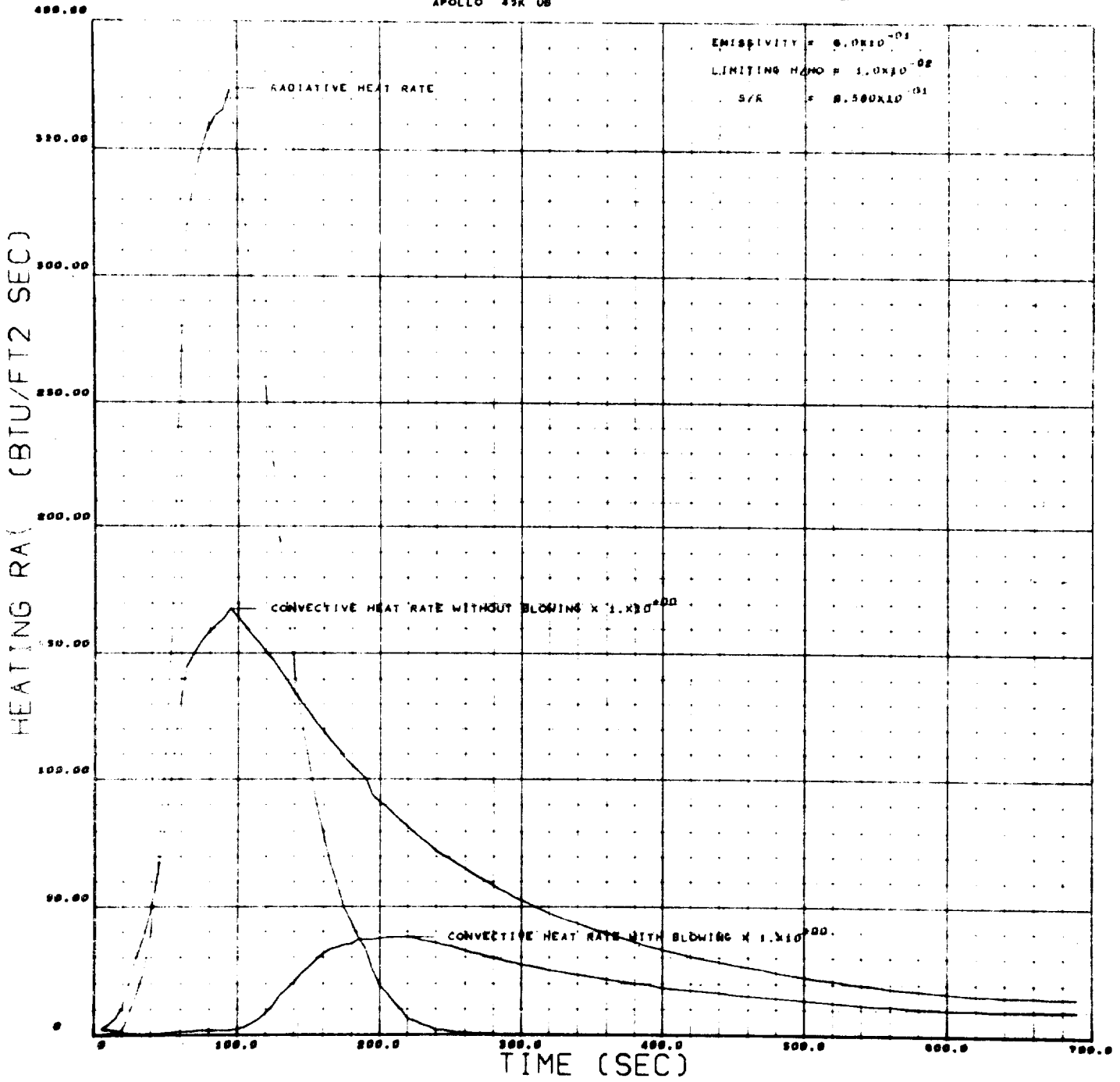


FIGURE A52

MATERIAL RESPONSE DATA

APOLLO 45K UB

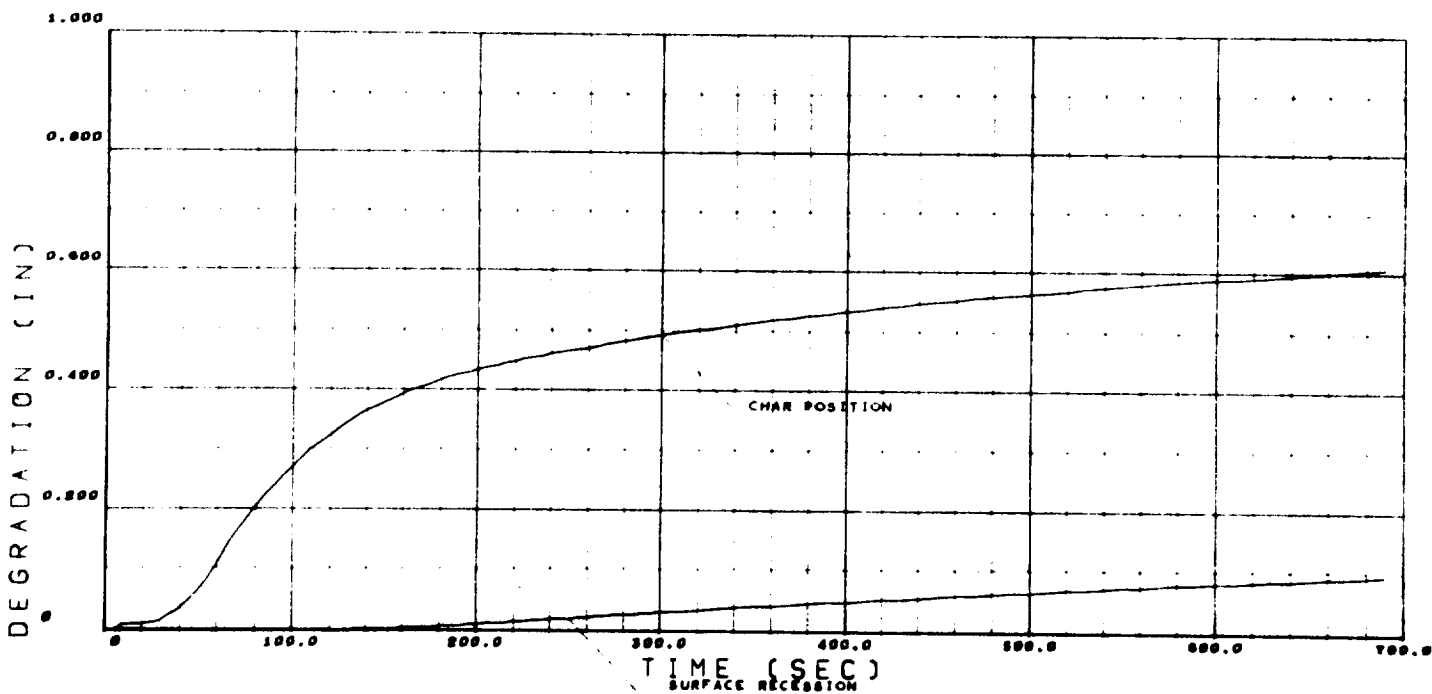
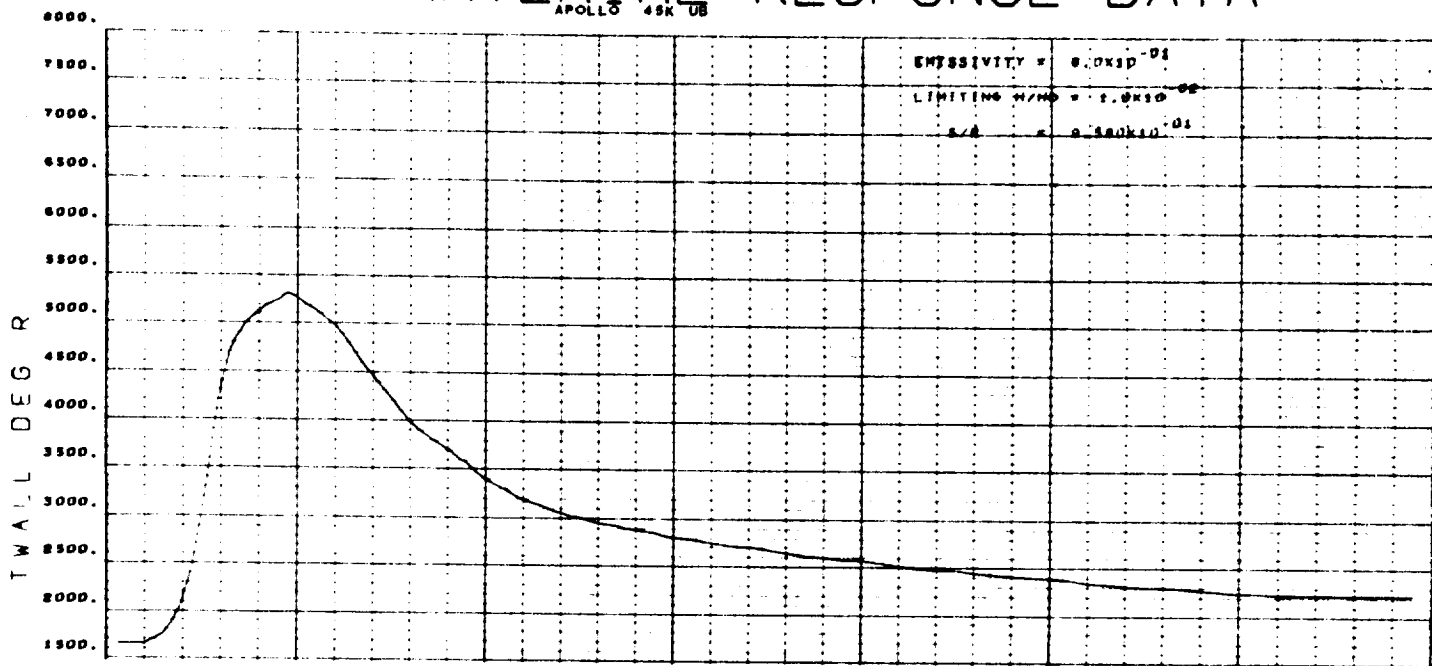


FIGURE A52

ENERGY ACCOMMODATION MECHANISMS

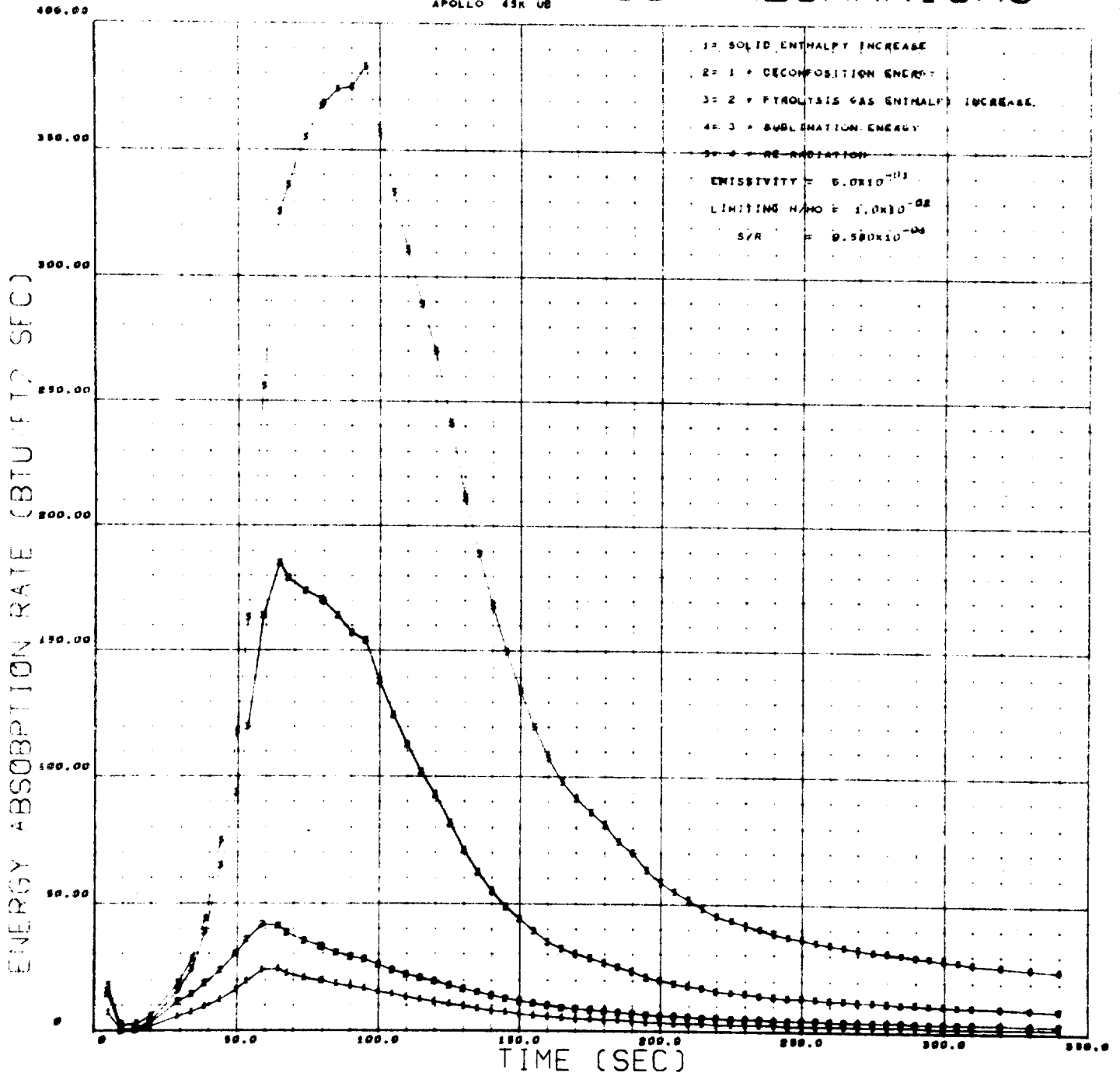


FIGURE A 53

HEATING RATE HISTORY

AFOLLO 43K UB

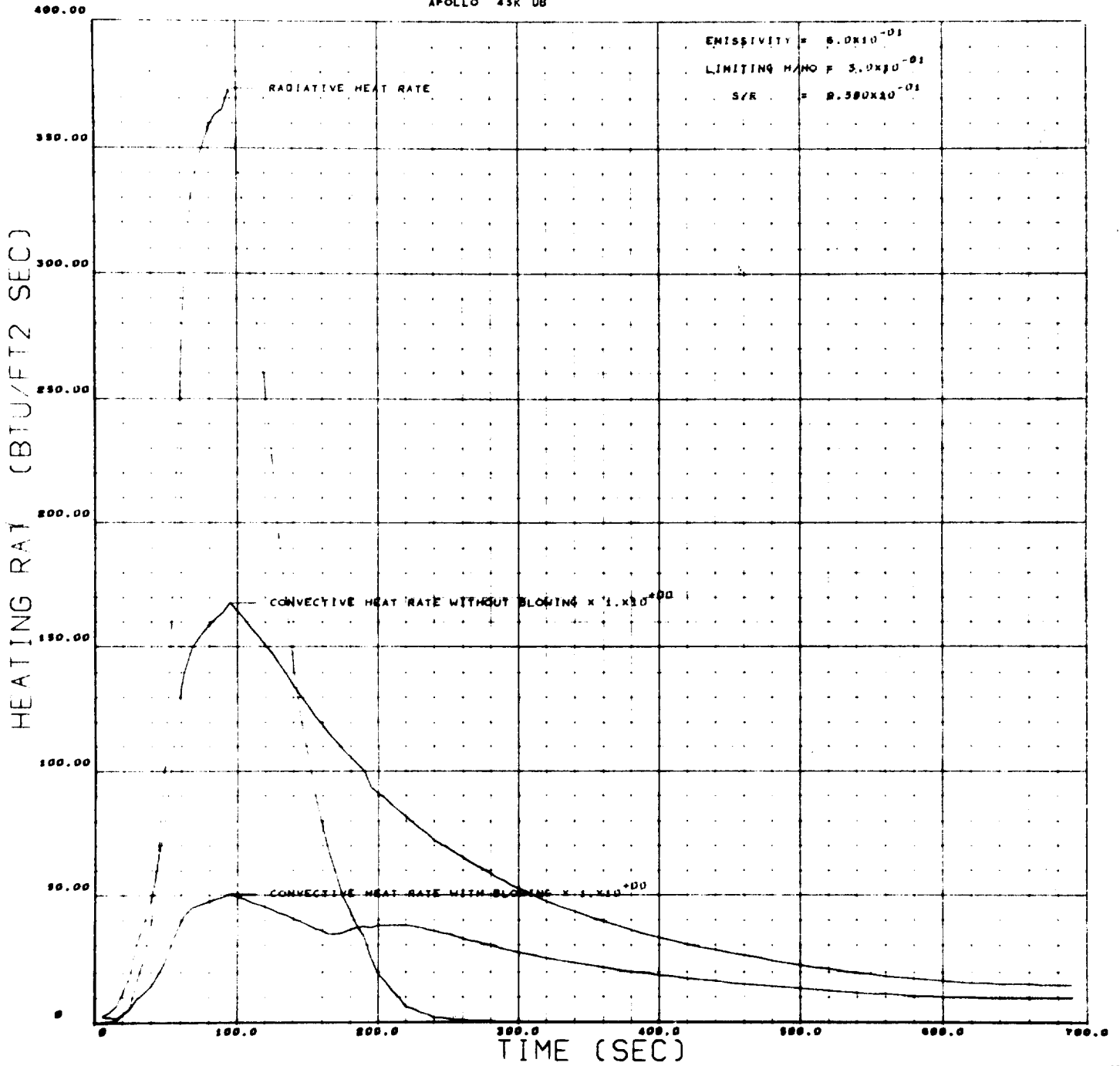


FIGURE A 53

MATERIAL RESPONSE DATA

APOLLO 45K UB

EMISSIVITY = 0.0X10⁻⁰¹
 LIMITING W/MO = 0.0X10⁻⁰¹
 S/A = 0.0X10⁻⁰¹

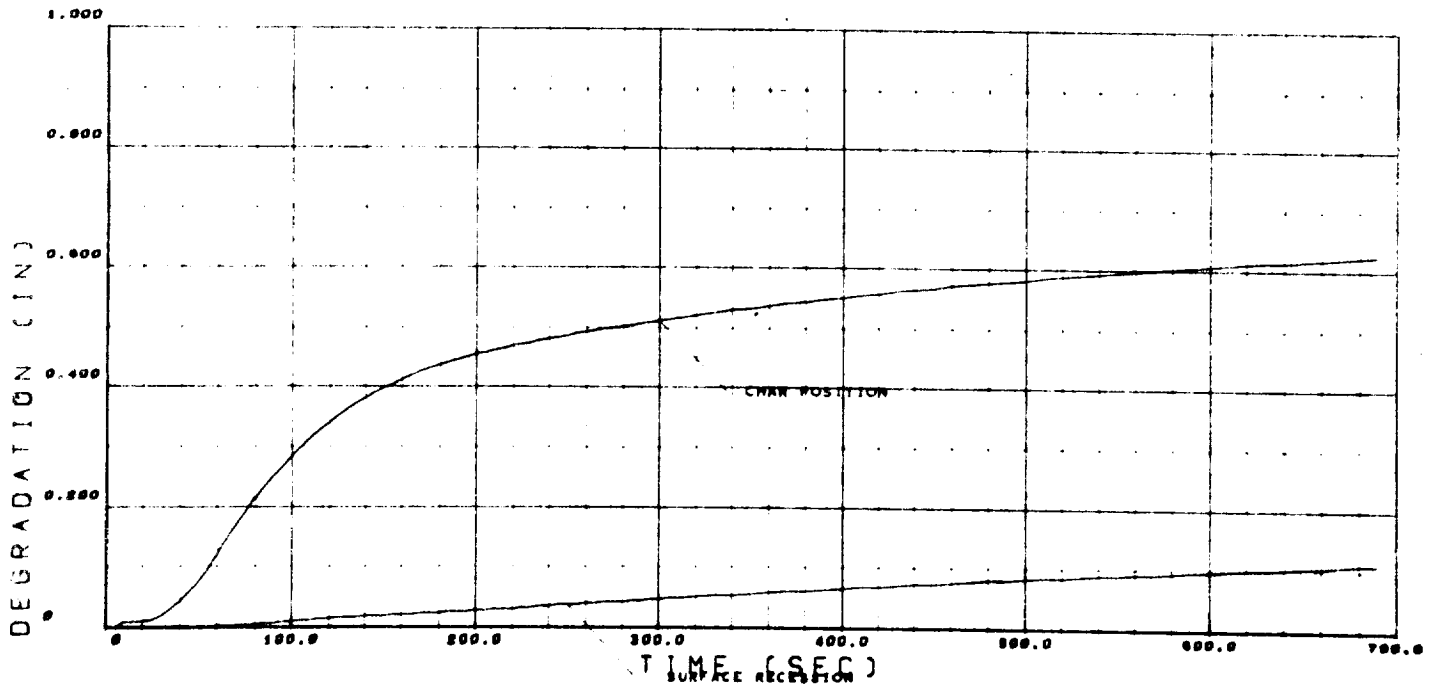
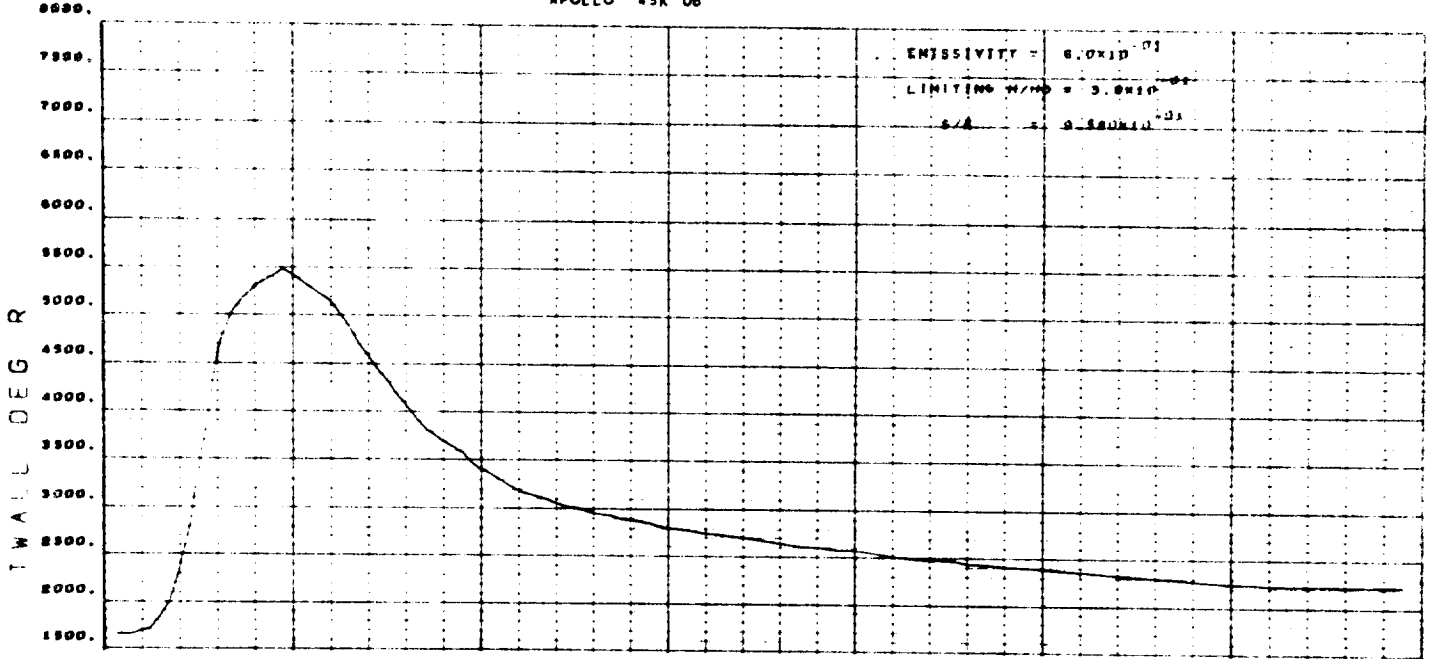


FIGURE A 53

ENERGY ACCOMMODATION MECHANISMS

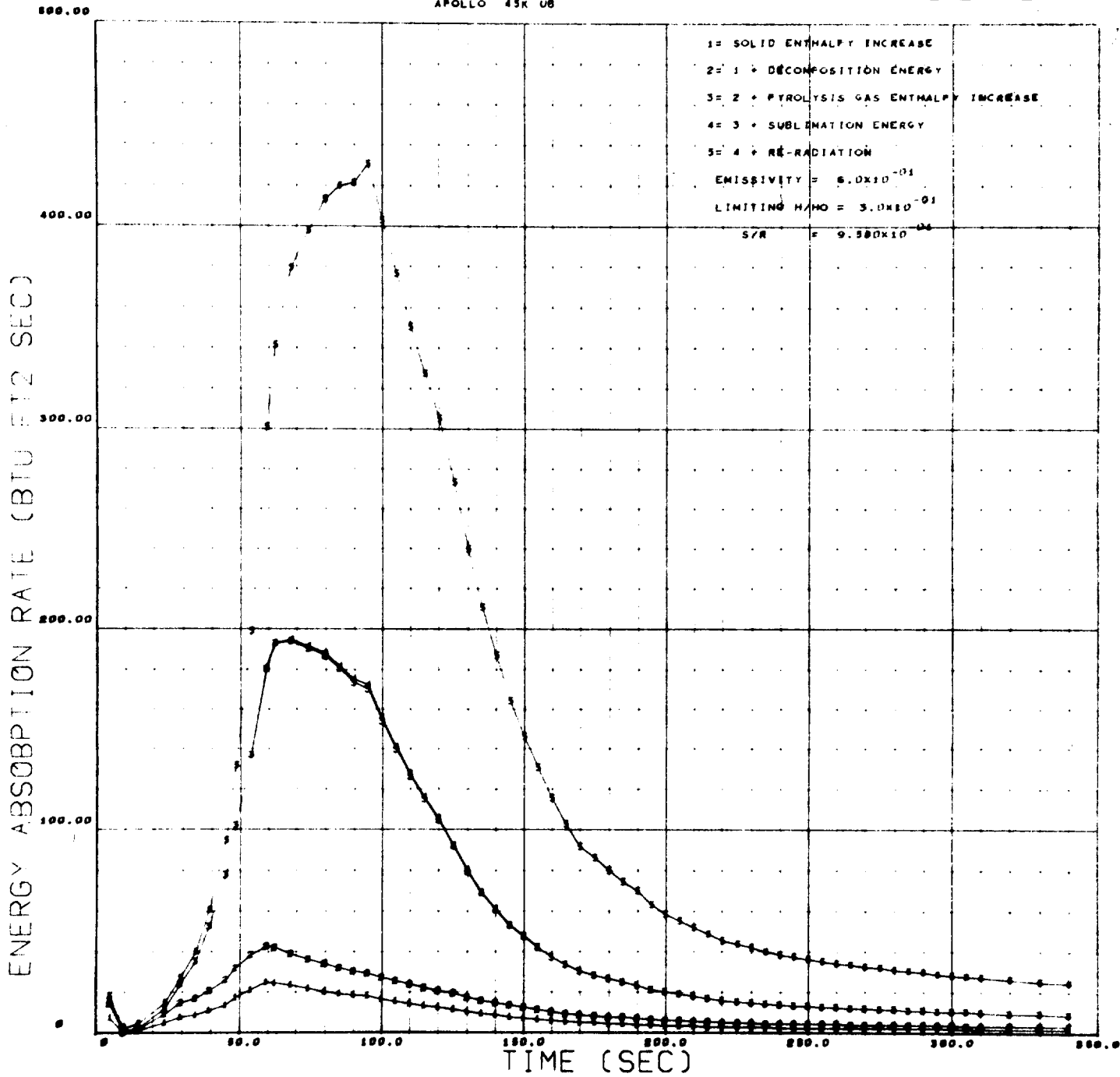


FIGURE A 54

HEATING RATE HISTORY

APOLLO 13K UB

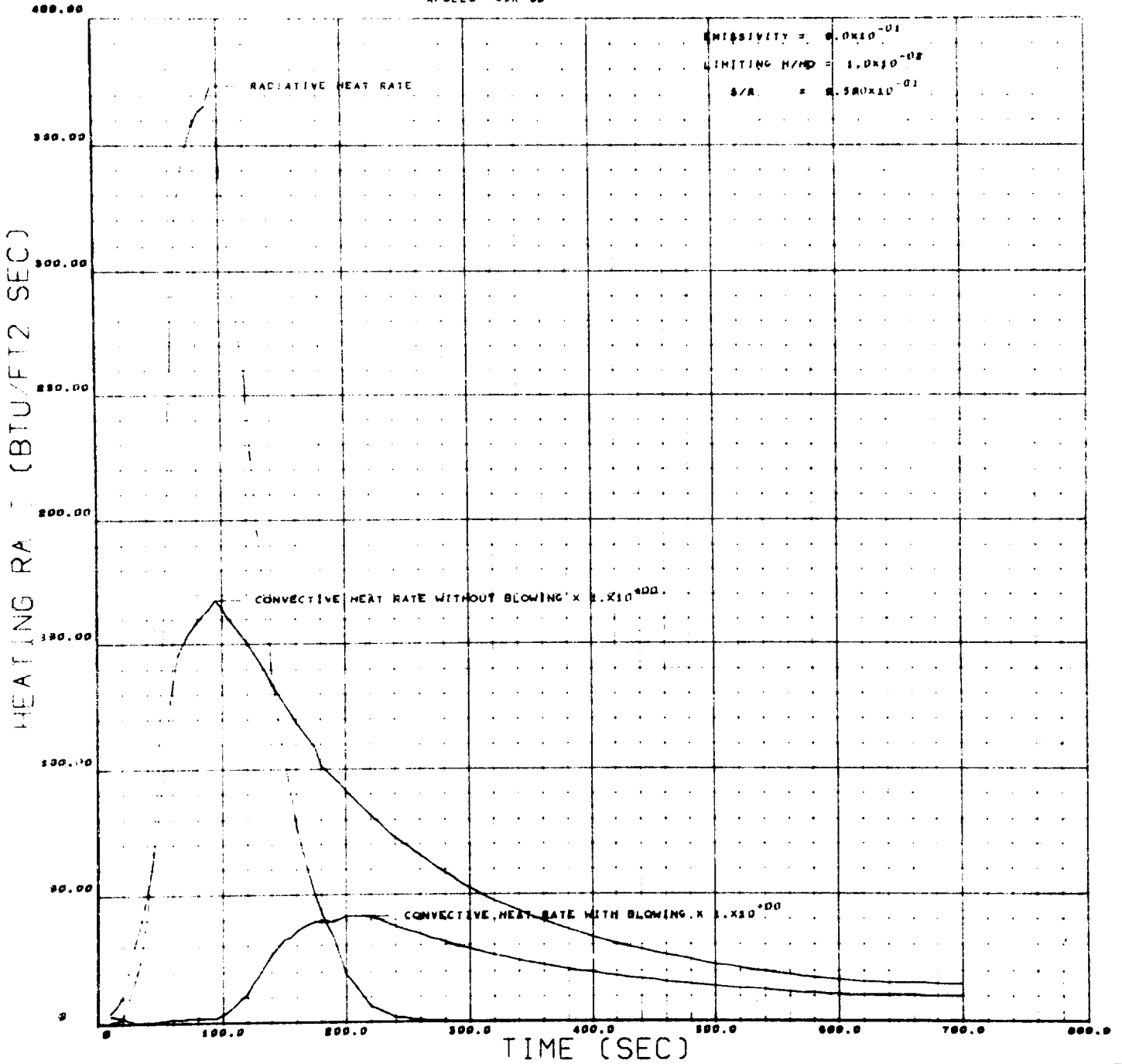


FIGURE A 54

MATERIAL RESPONSE DATA

APOLLO 43K UB

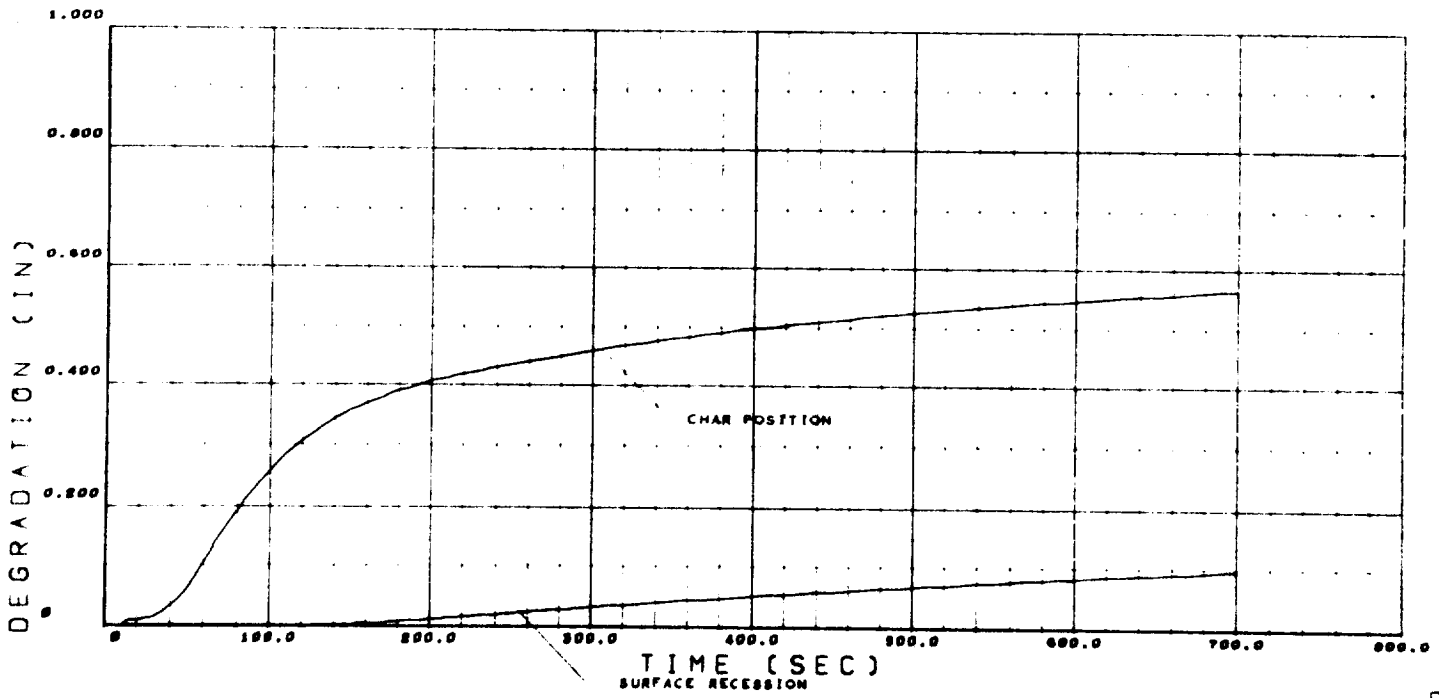
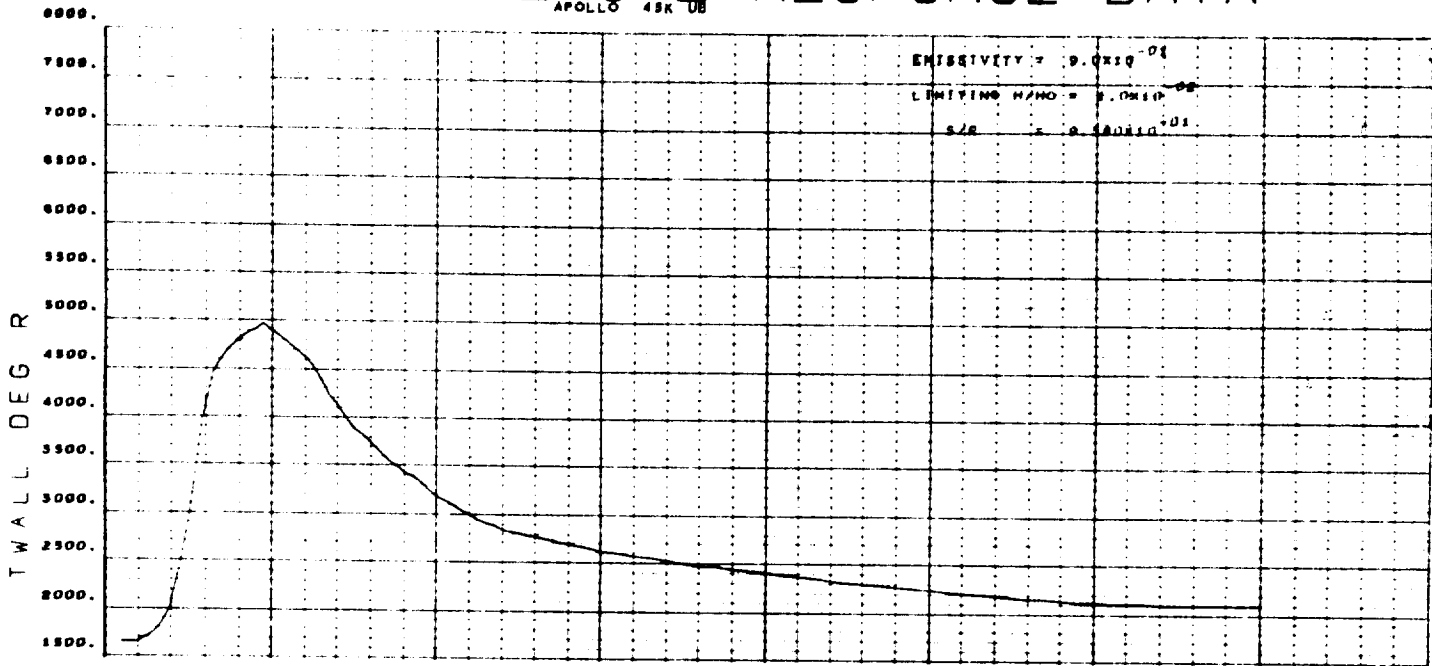


FIGURE A 54

ENERGY ACCOMMODATION MECHANISMS

APOLLO 45K US

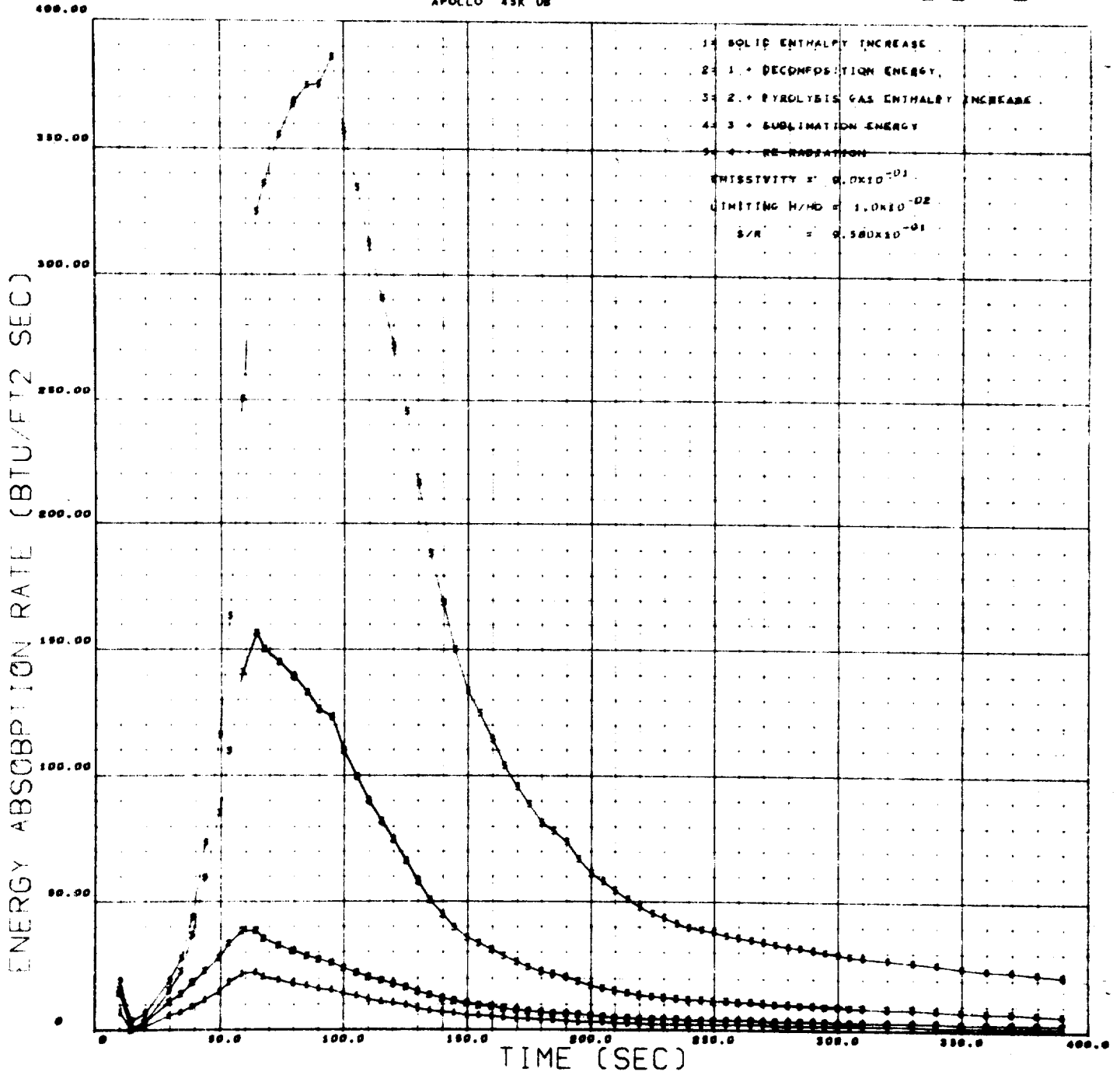


FIGURE A 55

HEATING RATE HISTORY

APOLLO 13K UB

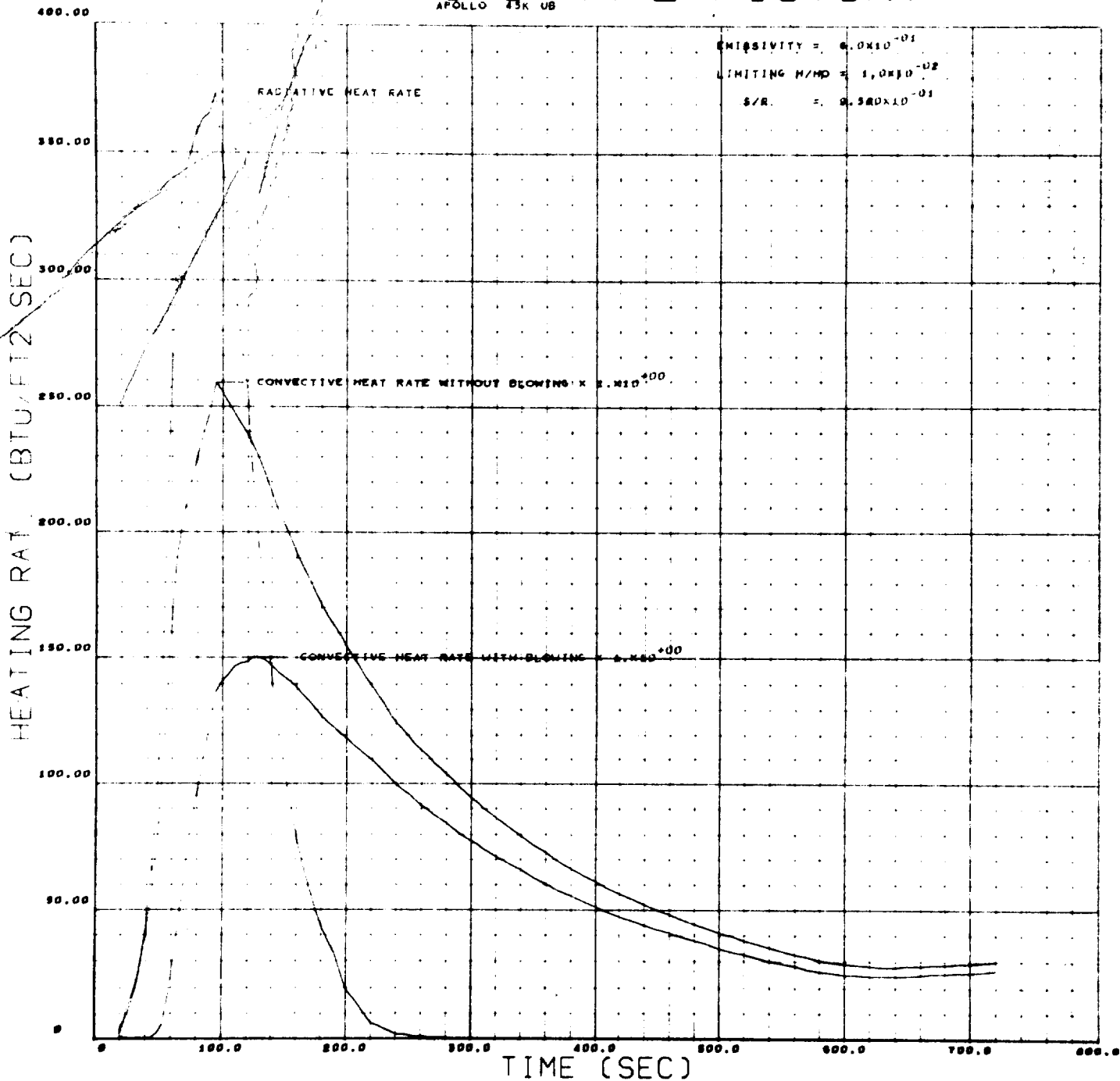


FIGURE A 55

MATERIAL RESPONSE DATA

APOLLO 4SR US

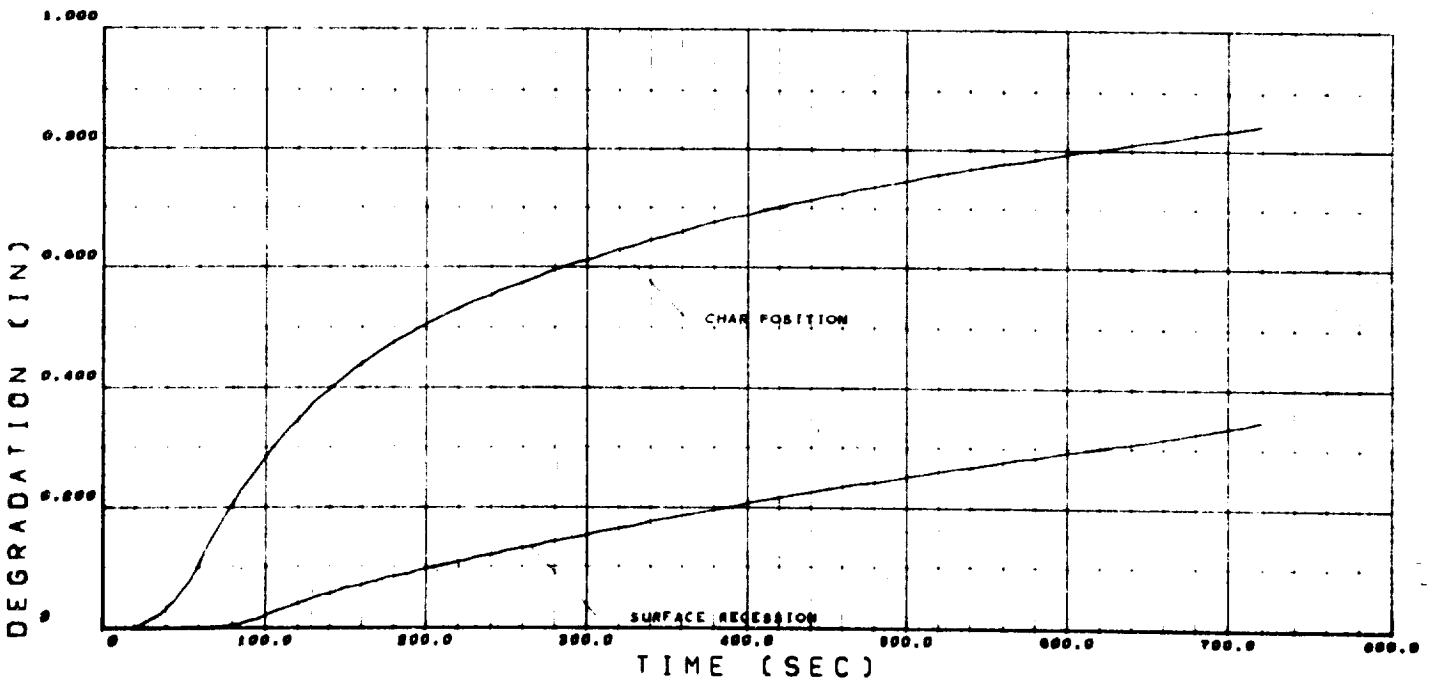
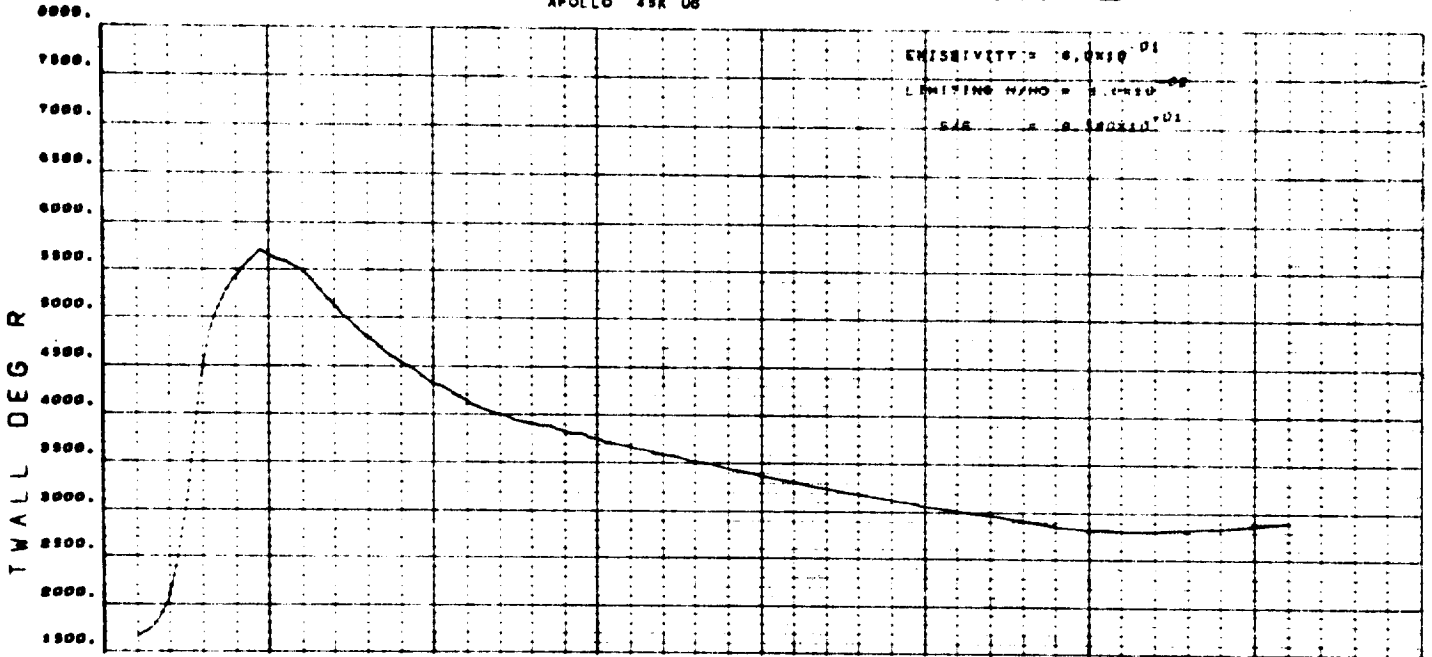


FIGURE A 55

ENERGY ACCOMMODATION MECHANISMS

APOLLO 43K UB

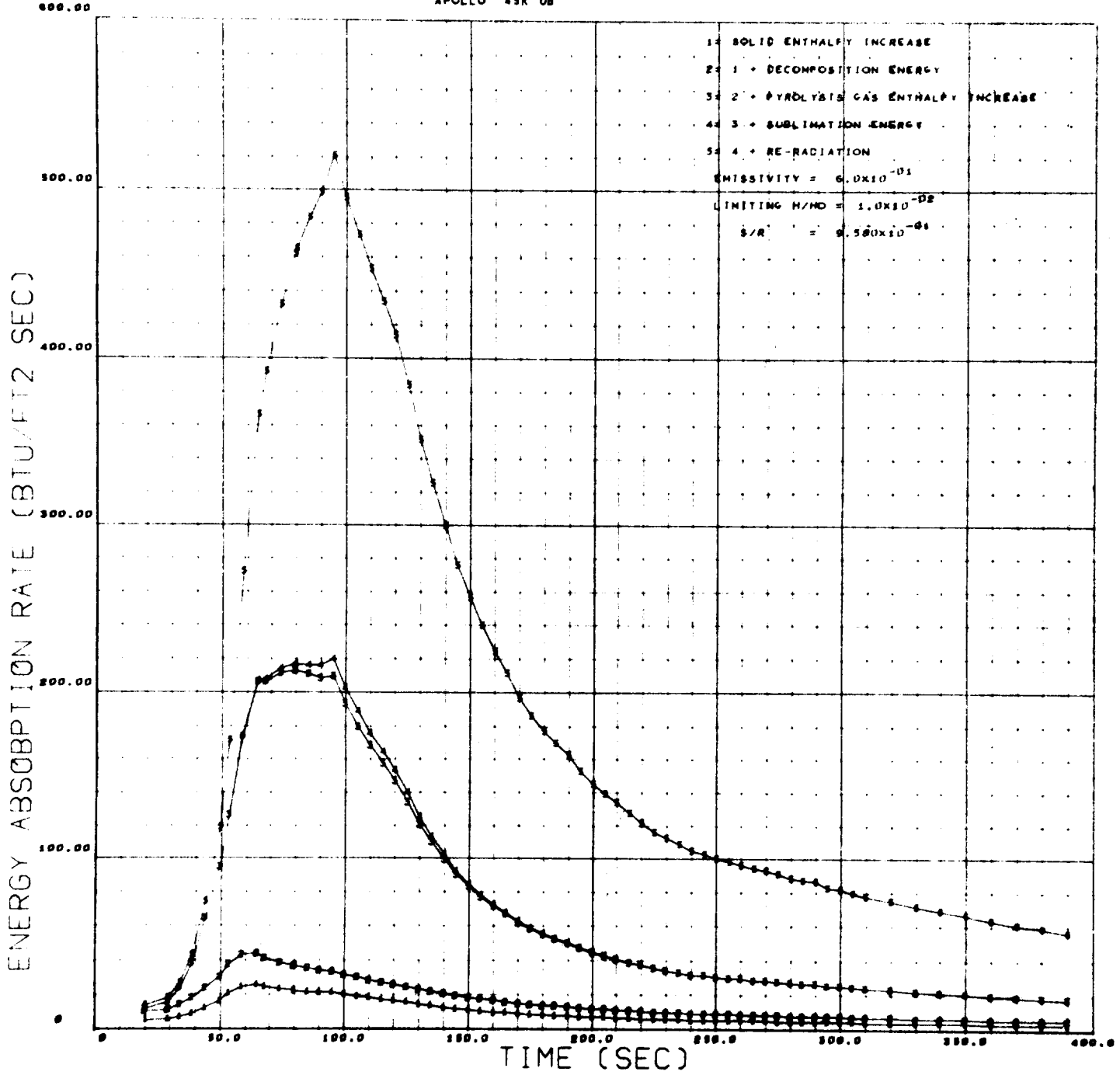


FIGURE A 56

HEATING RATE HISTORY

APOLLO 25K US

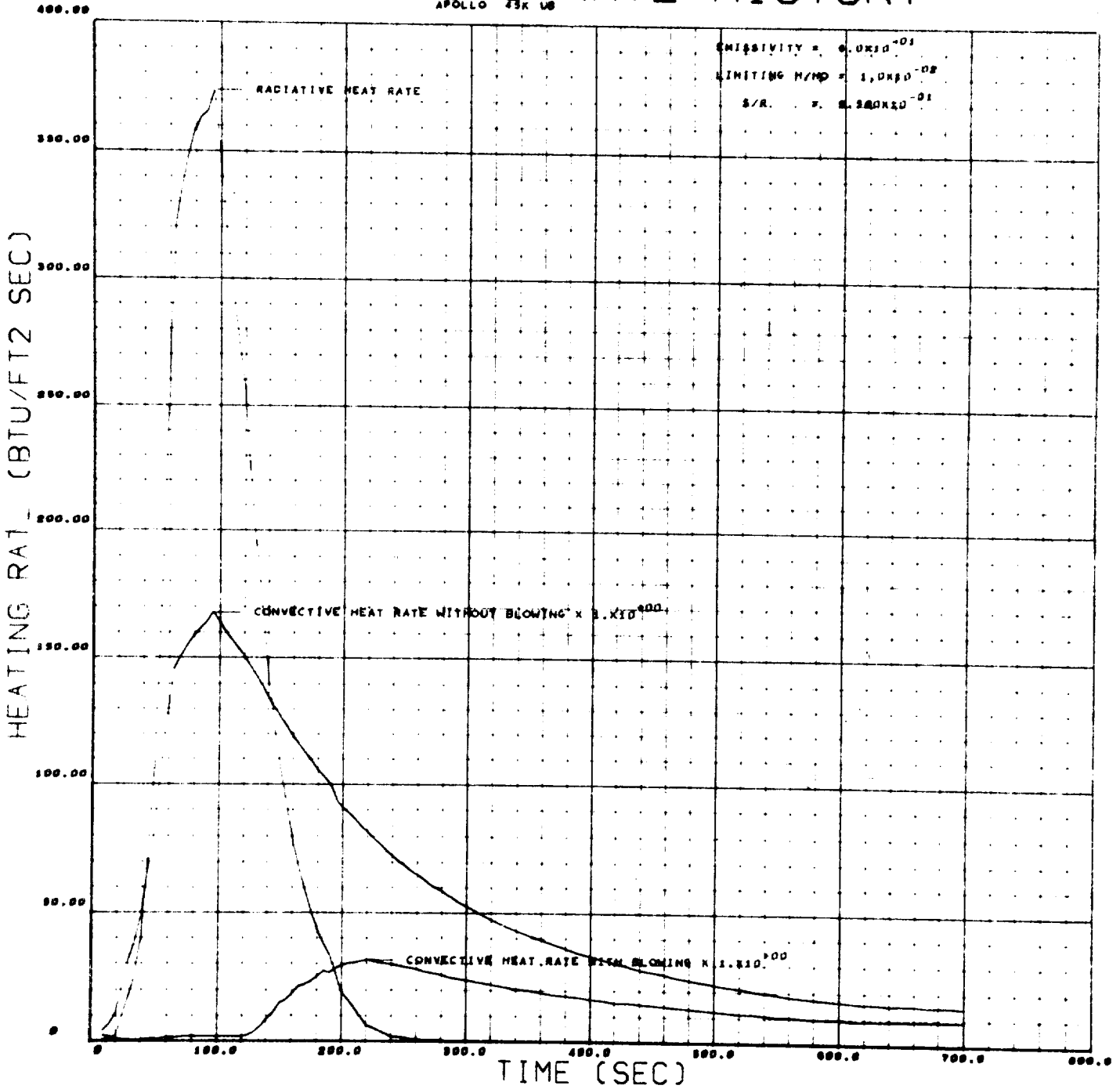


FIGURE A 56

MATERIAL RESPONSE DATA

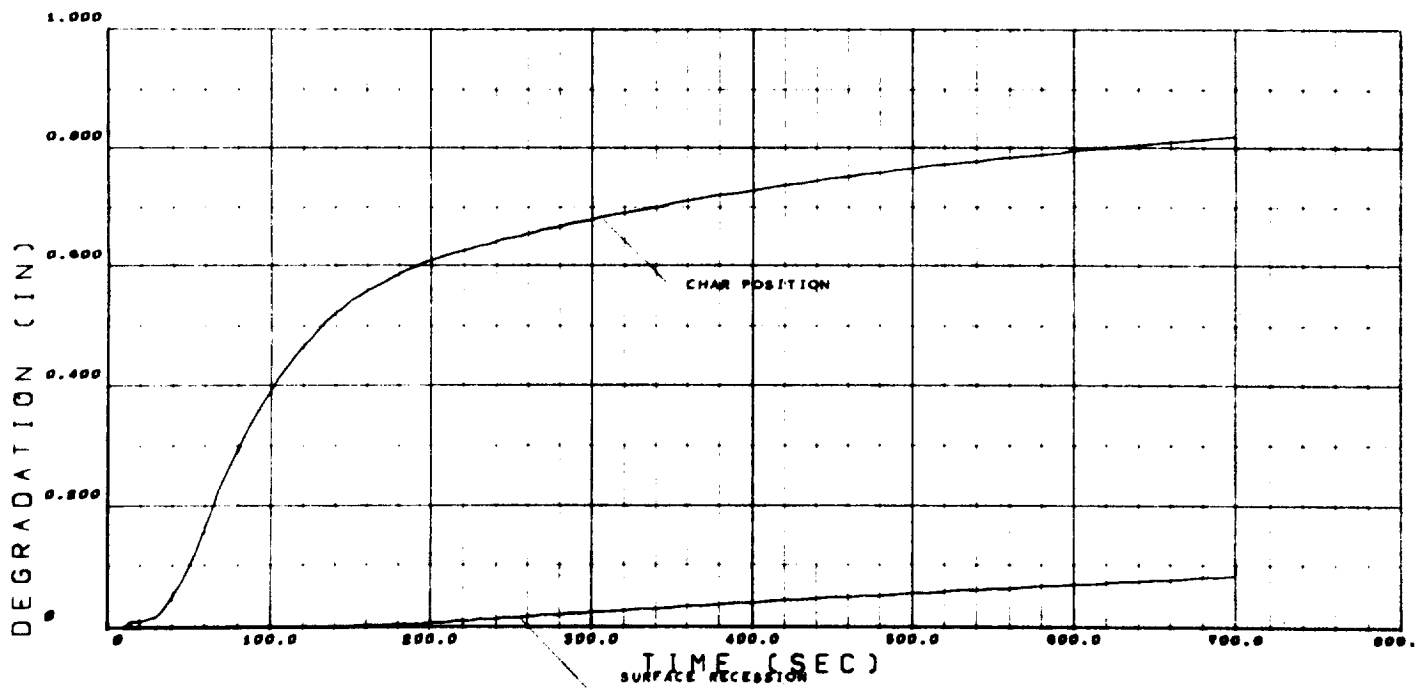
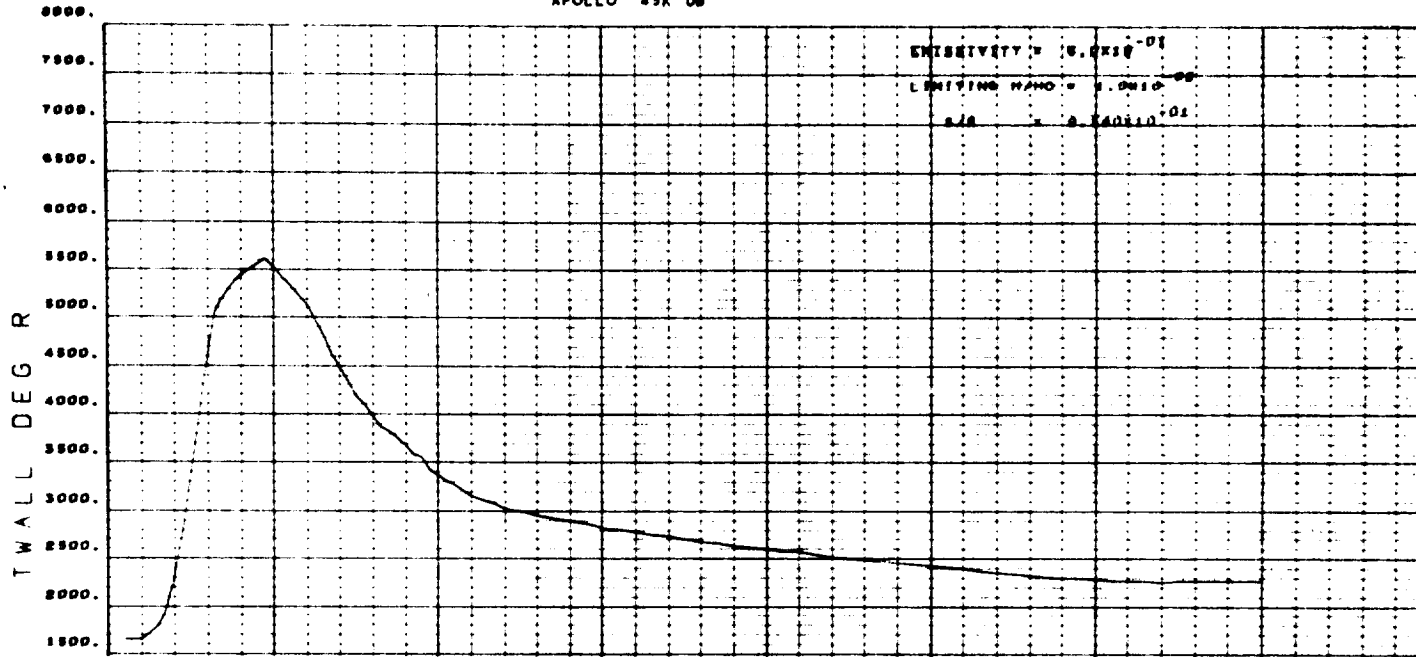


FIGURE A 56

ENERGY ACCOMMODATION MECHANISMS

APOLLO 48K LB

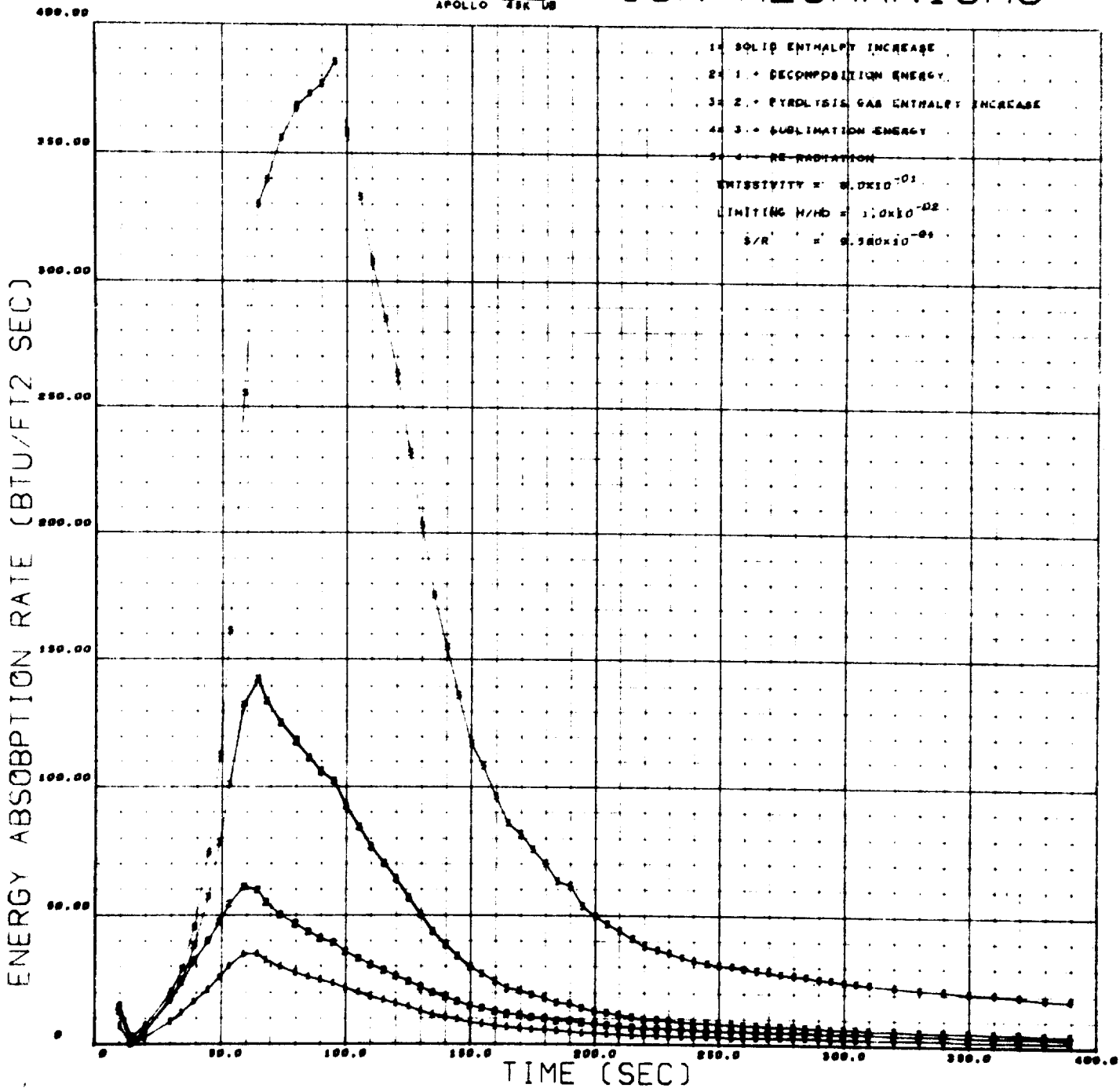


FIGURE A57

HEATING RATE HISTORY

APOLLO 43K UB

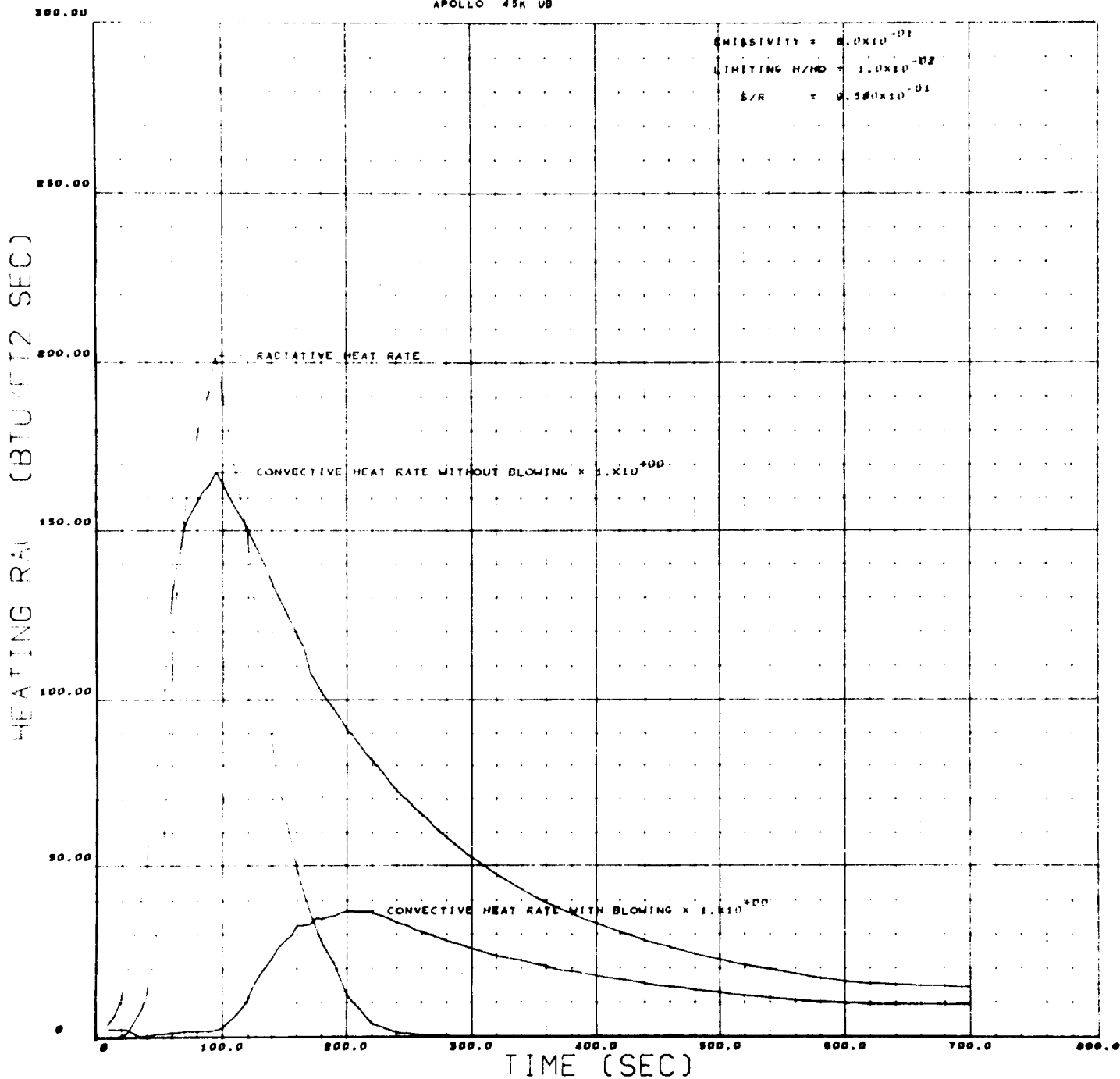


FIGURE A 57

MATERIAL RESPONSE DATA

APOLLO 45K UB

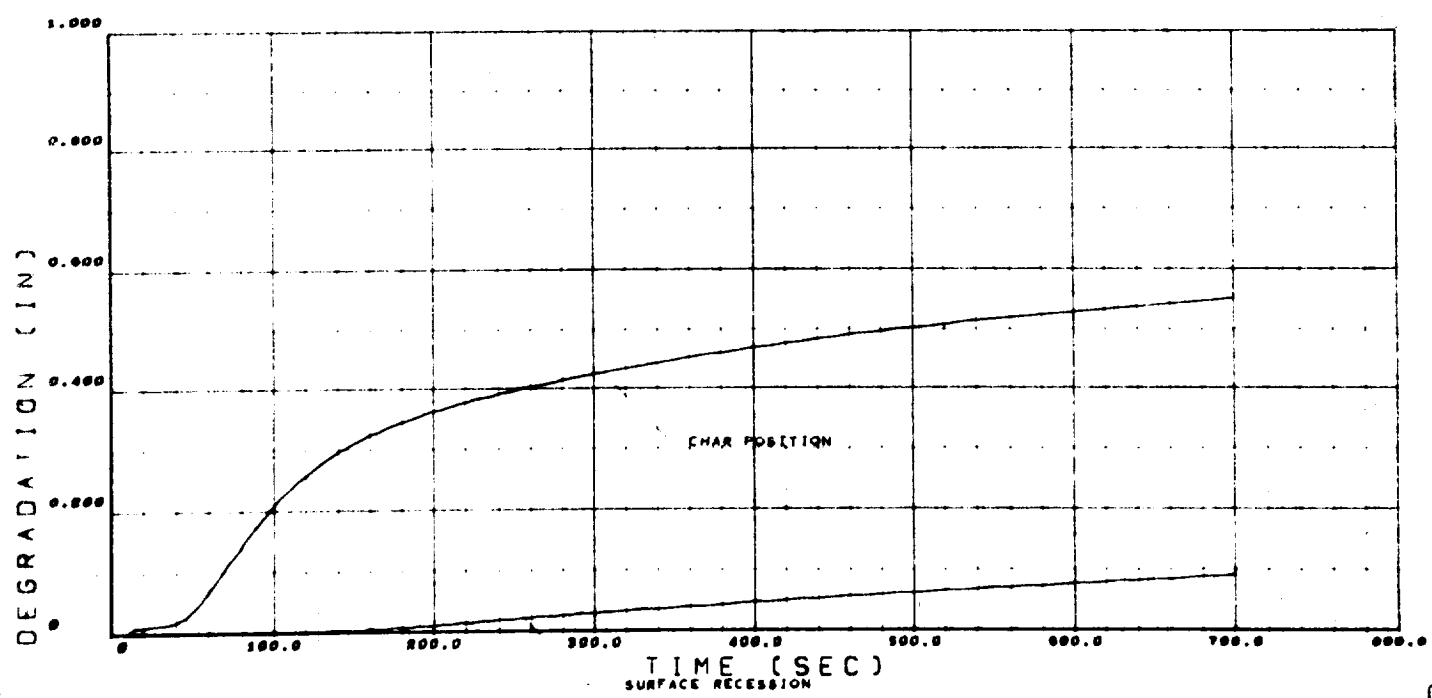
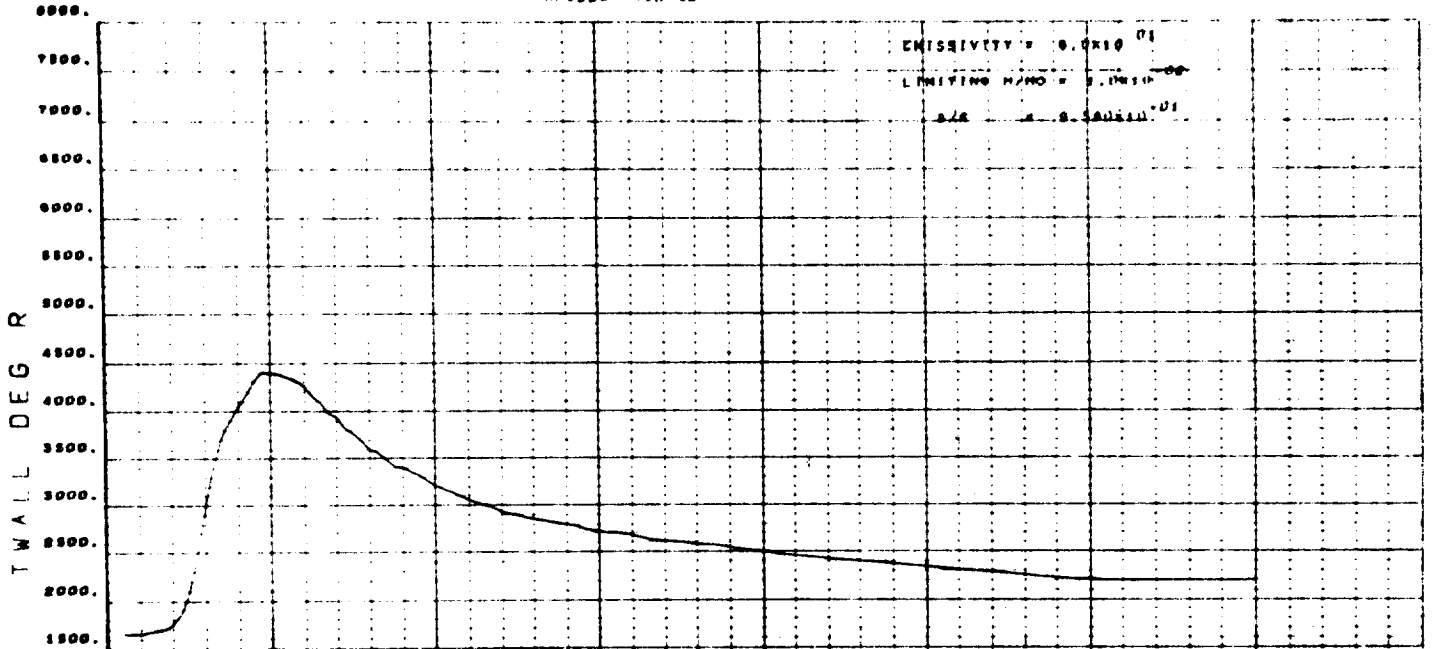


FIGURE A 57

ENERGY ACCOMMODATION MECHANISMS

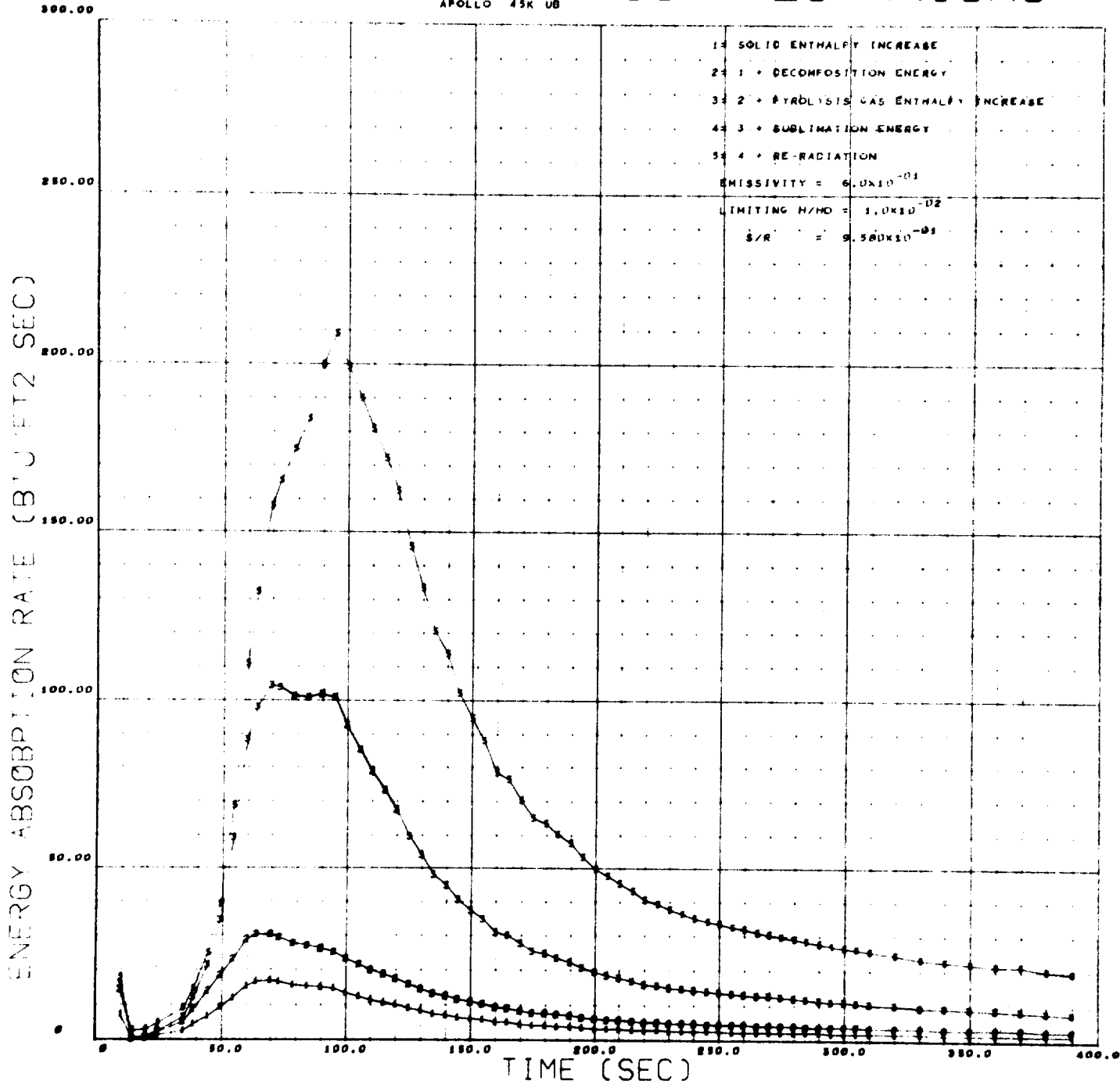


FIGURE A58

HEATING RATE HISTORY

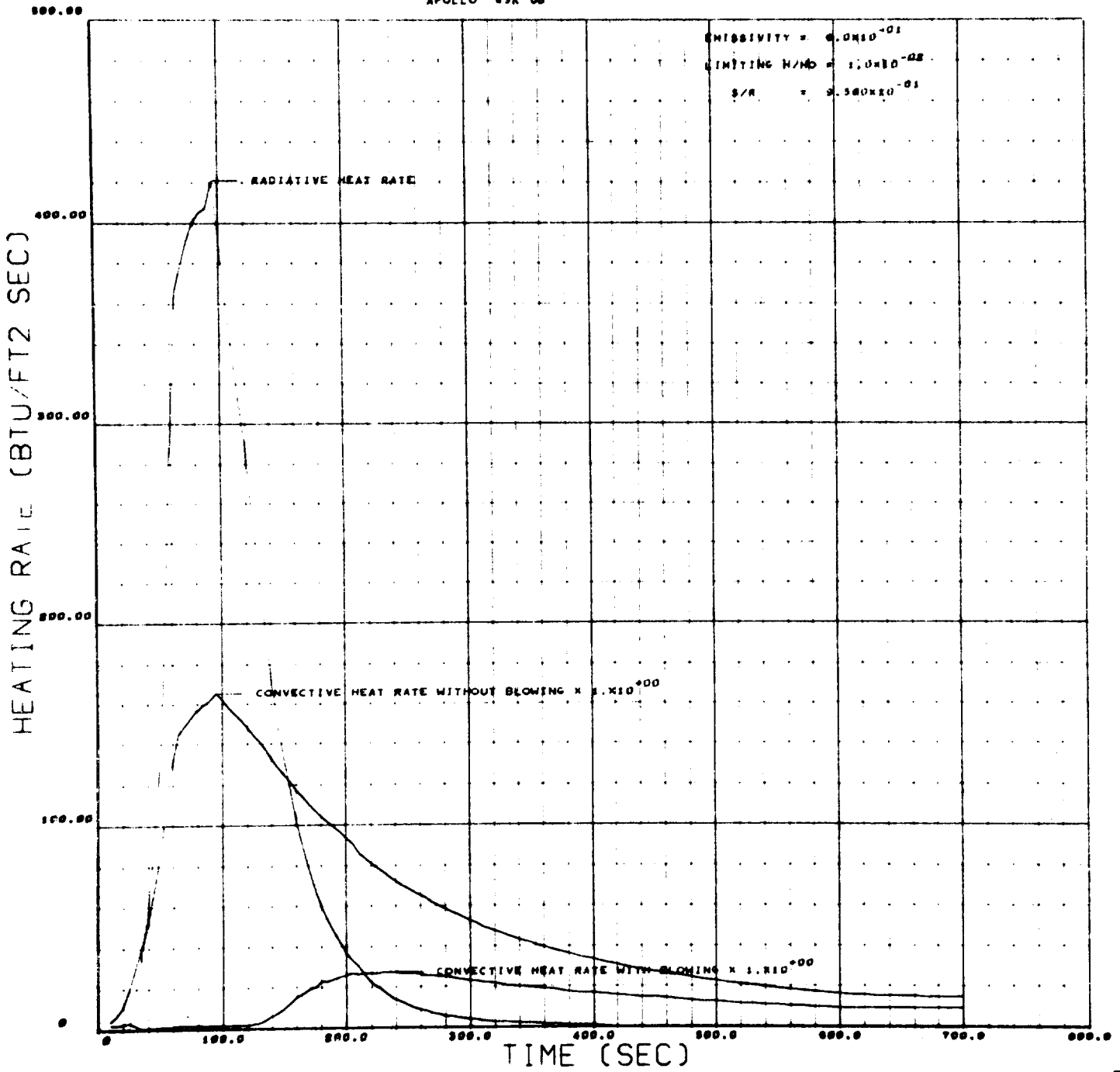


FIGURE A 58

MATERIAL RESPONSE DATA

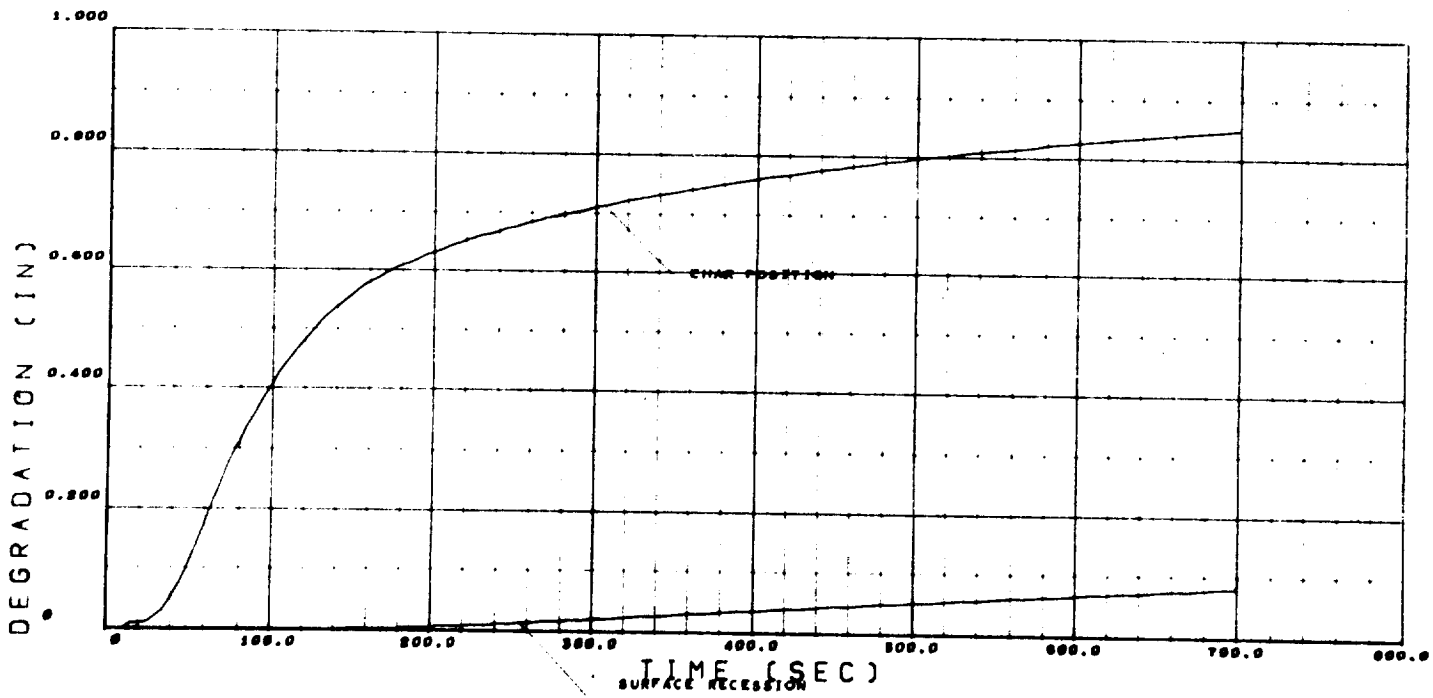
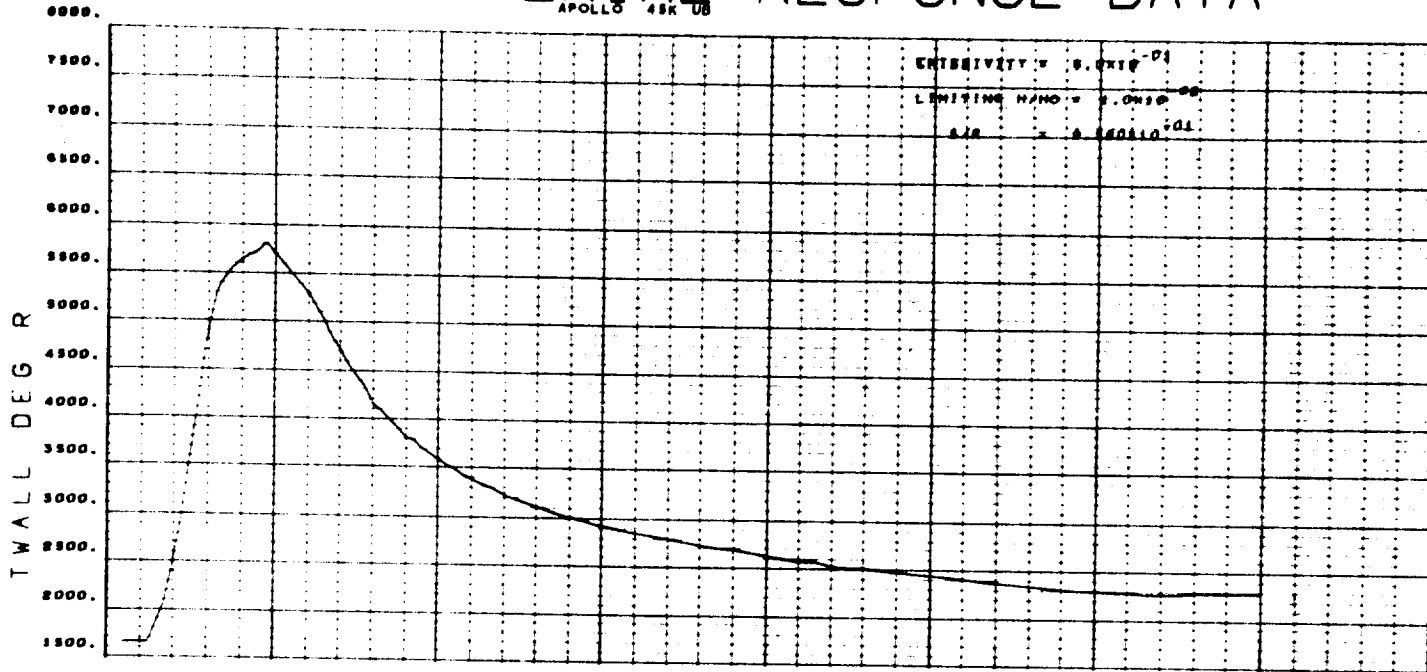


FIGURE A58

ENERGY ACCOMMODATION MECHANISMS

APOLLO 13R US

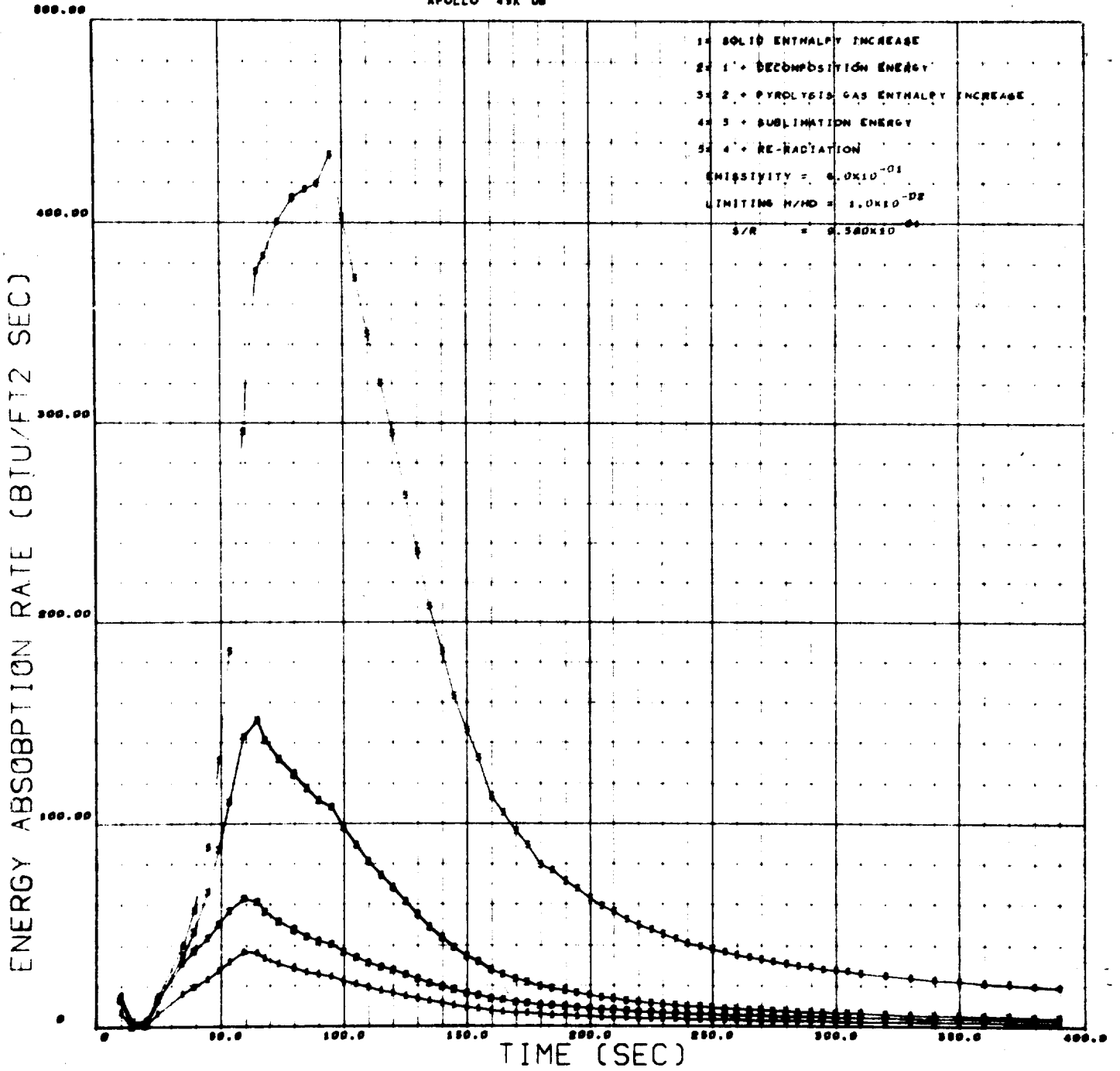


FIGURE A 59

HEATING RATE HISTORY

APOLLO 30K UB

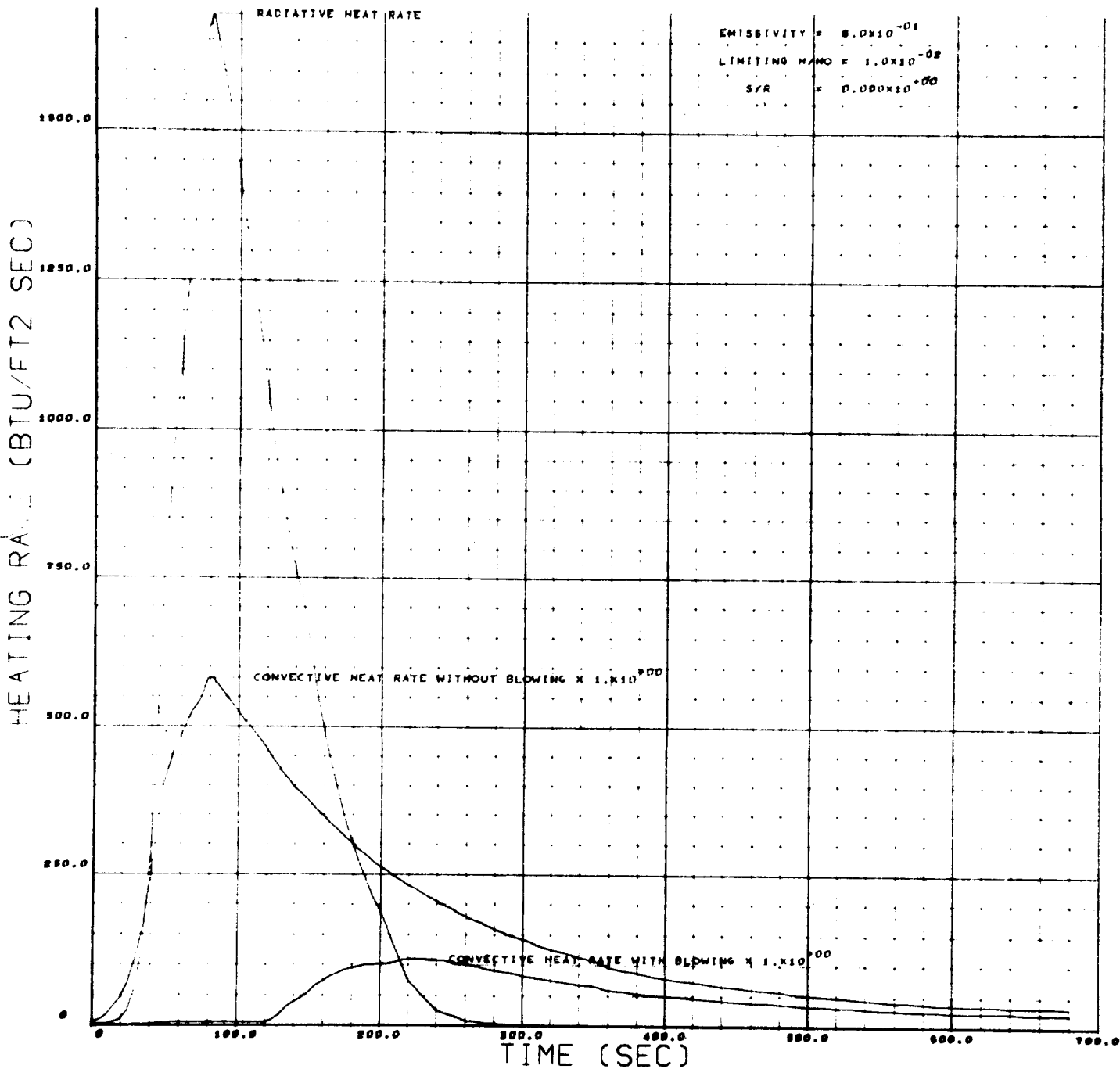


FIGURE A-59

MATERIAL RESPONSE DATA

APOLLO 30K US

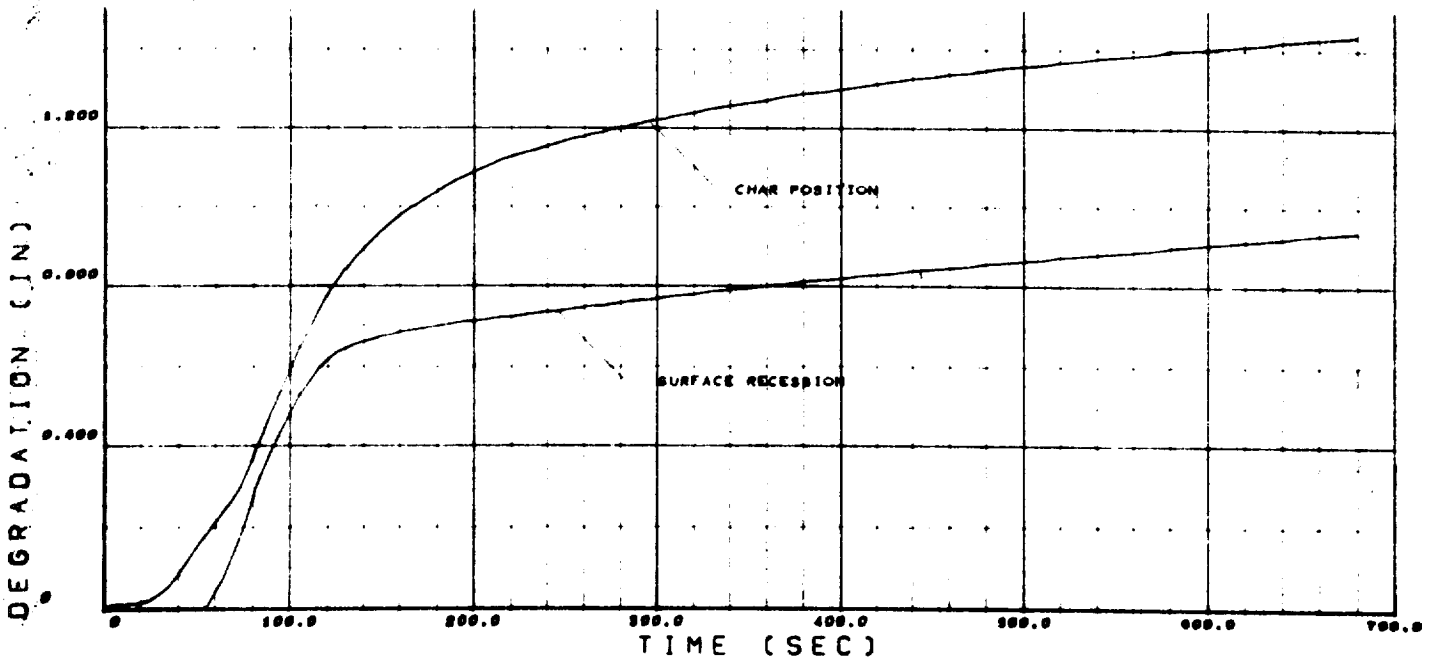
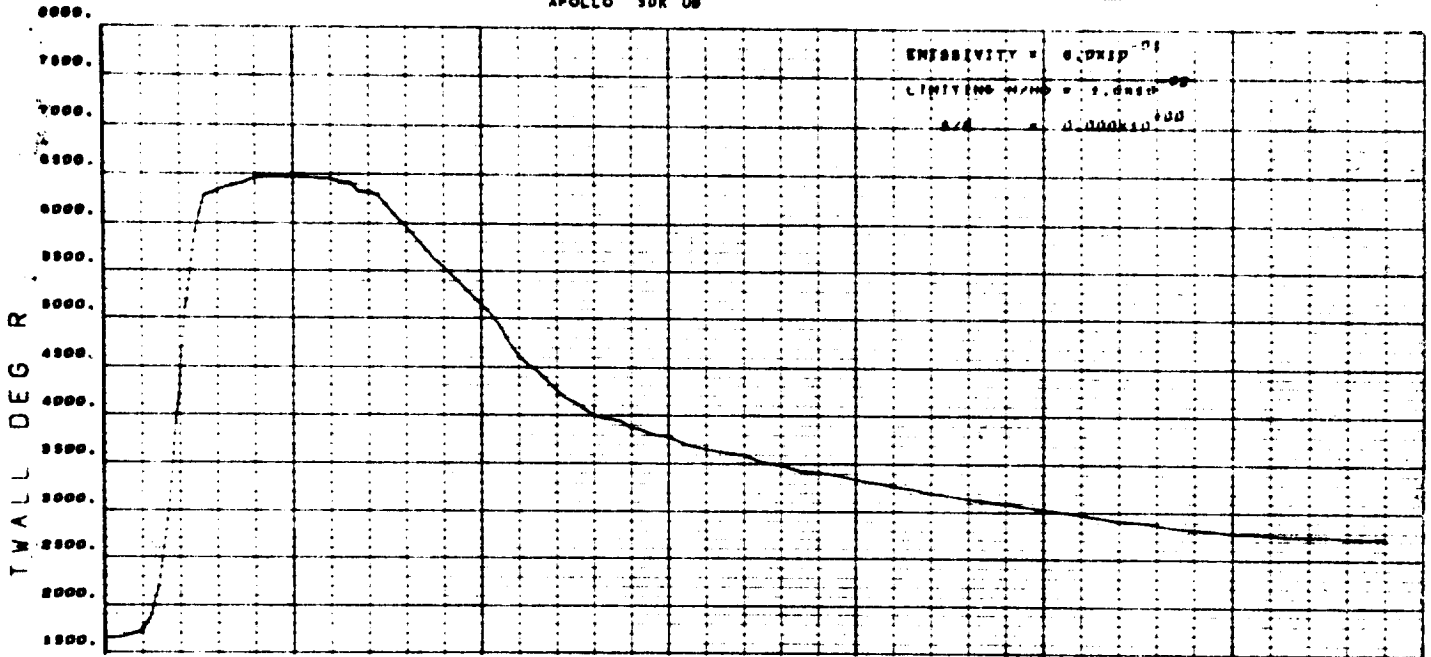


FIGURE A59

ENERGY ACCOMMODATION MECHANISMS

APOLLO FOR US

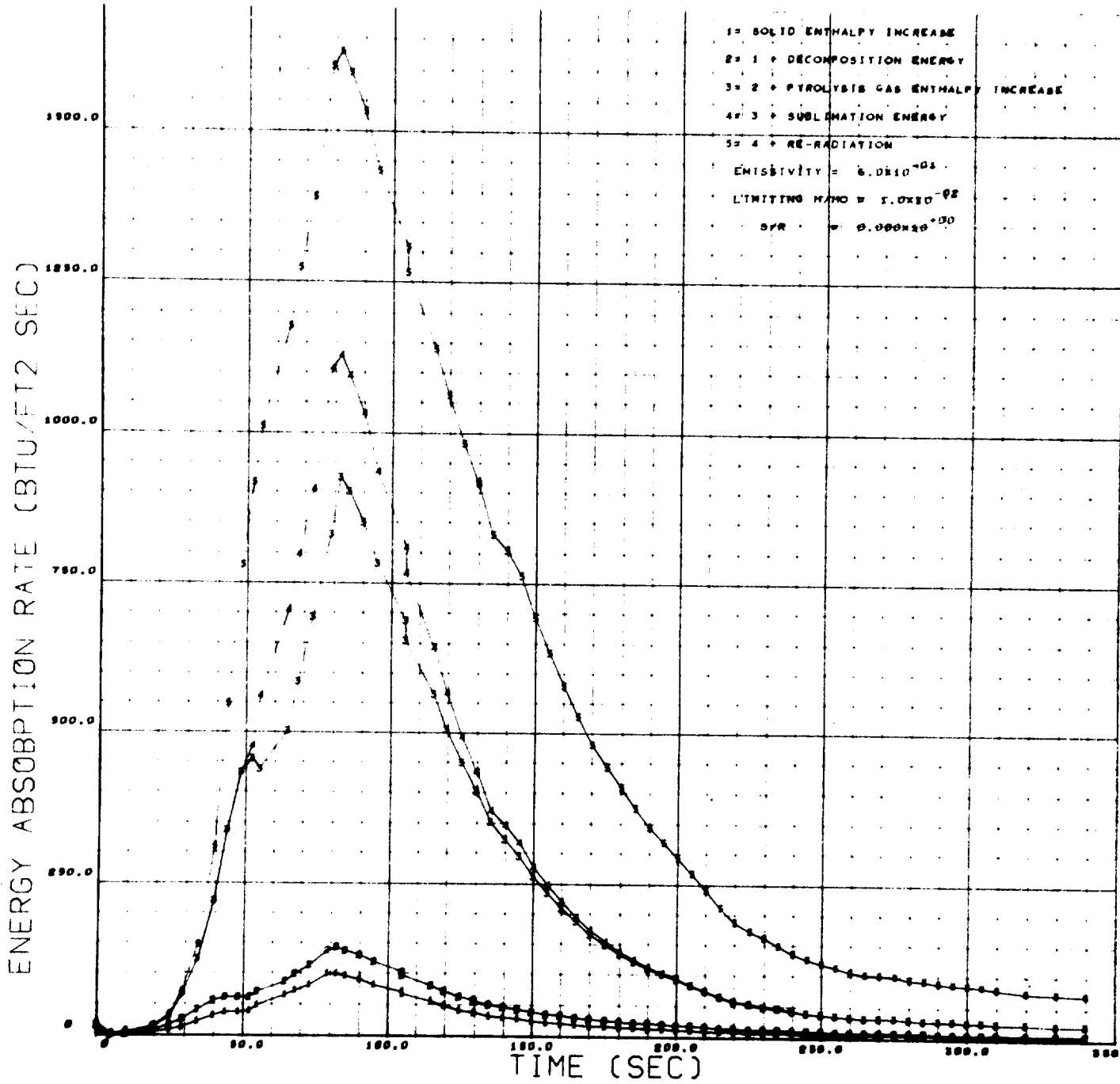


FIGURE A60

HEATING RATE HISTORY

APOLLO 13R US

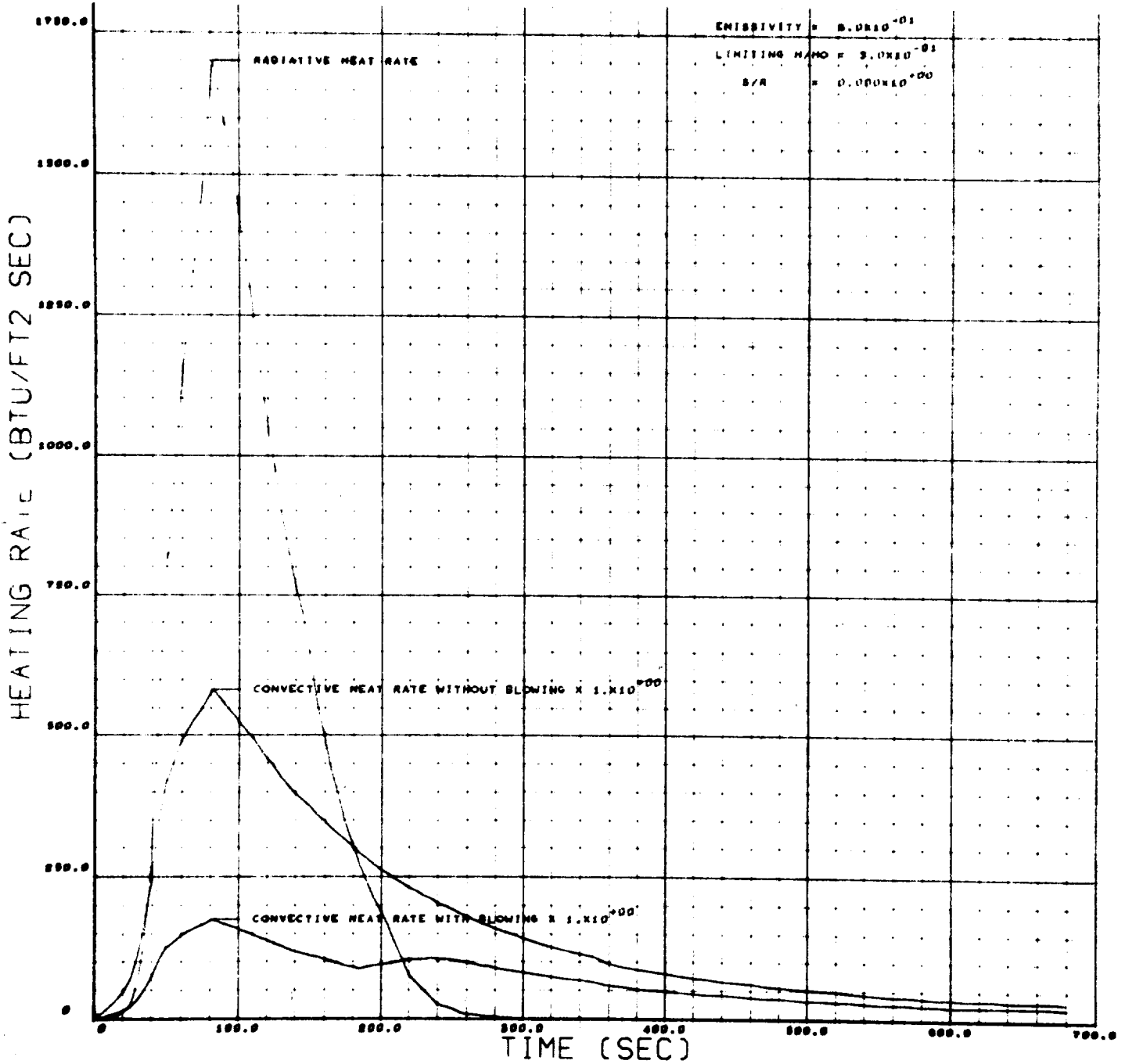


FIGURE A 60

MATERIAL RESPONSE DATA

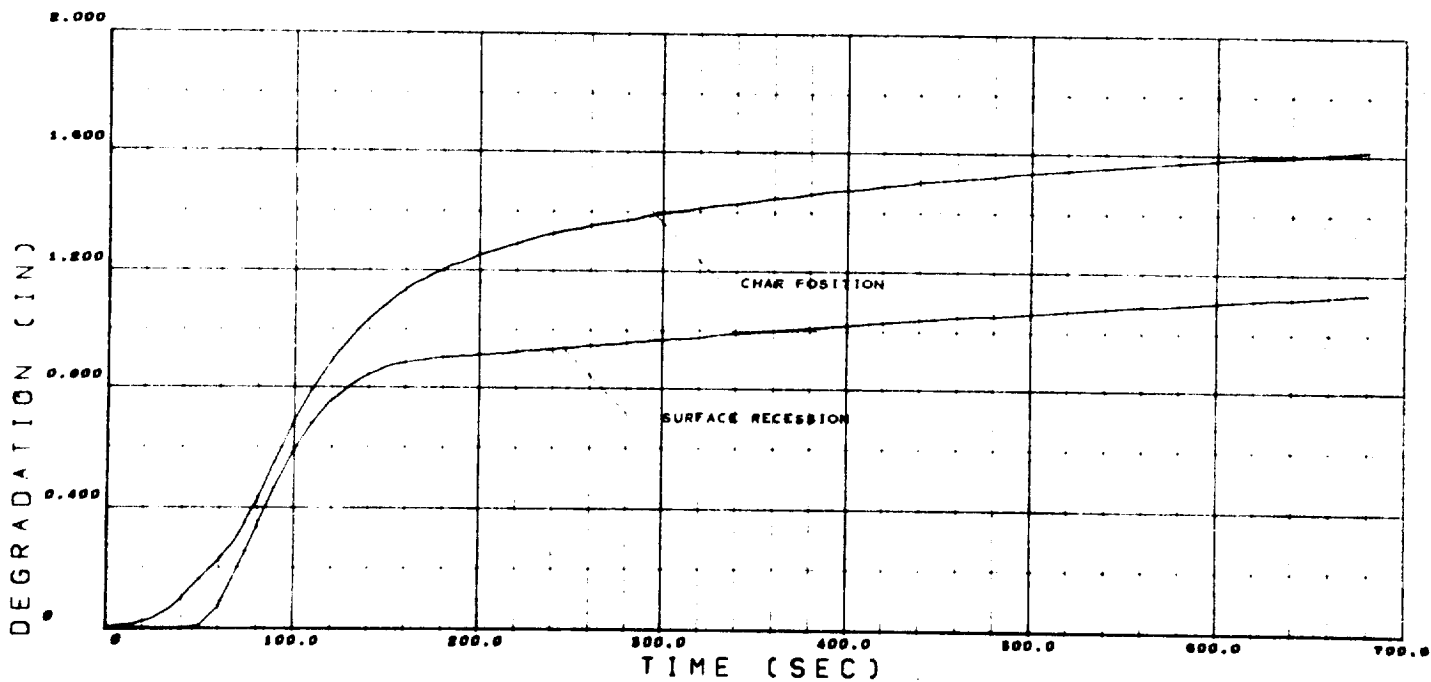
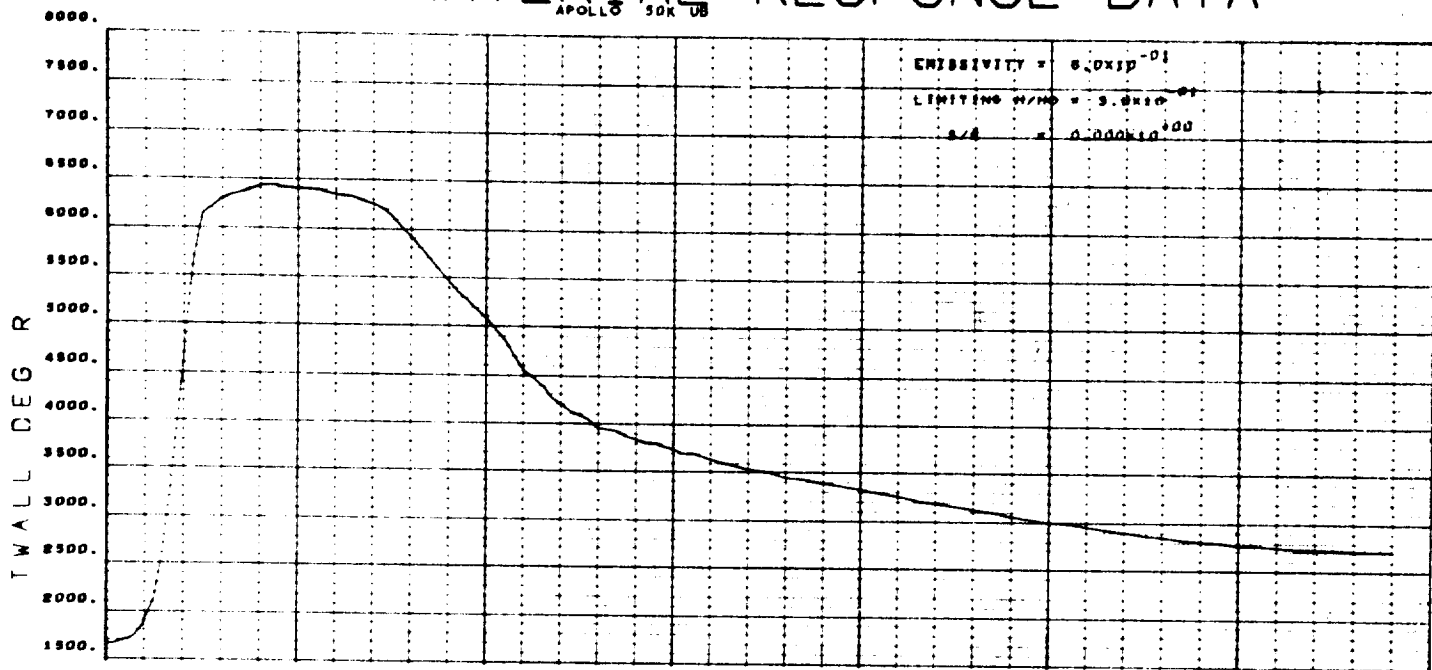


FIGURE A60

ENERGY ACCOMMODATION MECHANISMS

APOLLO 30K UB

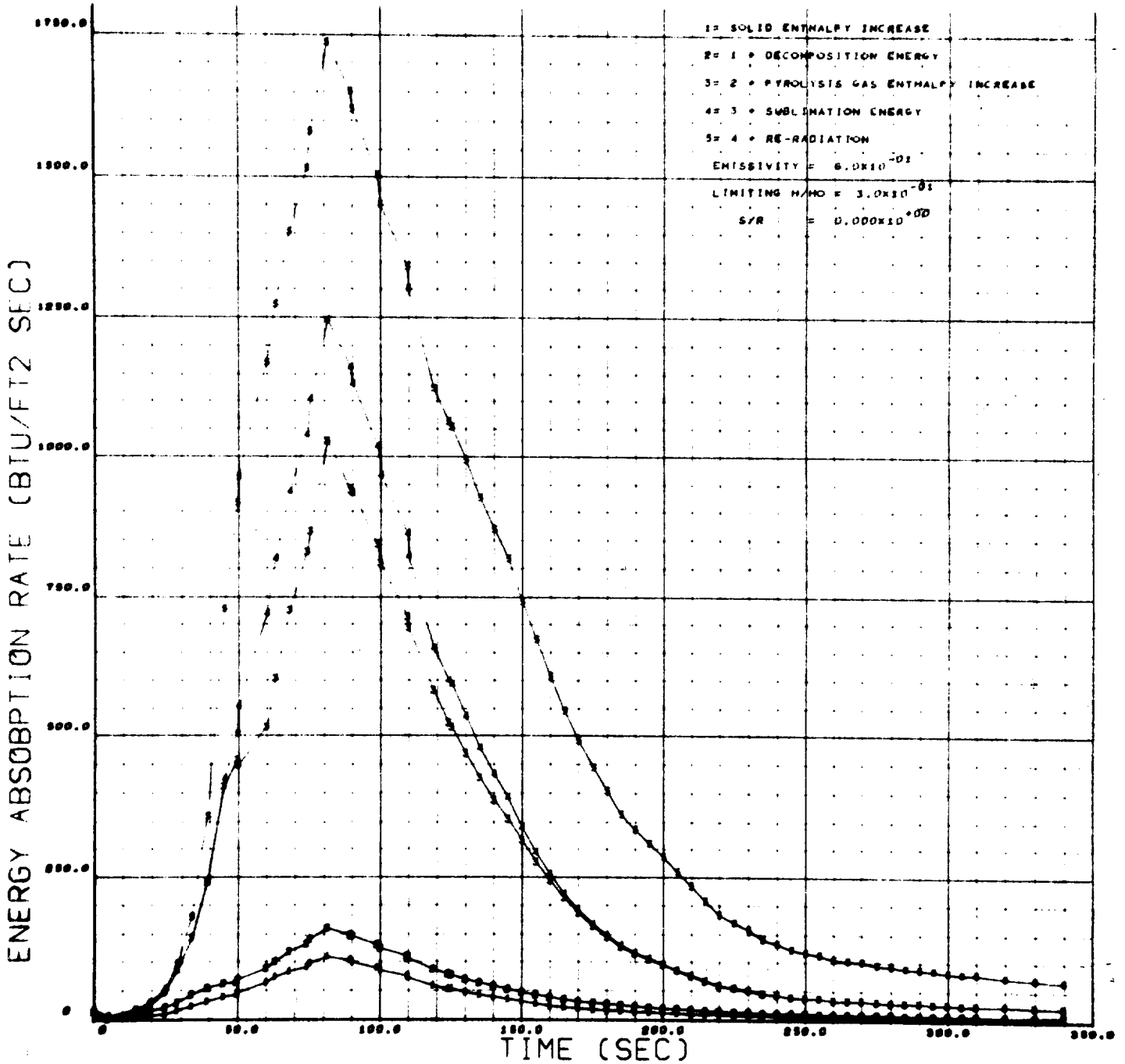


FIGURE A 61

HEATING RATE HISTORY

APOLLO 30K US

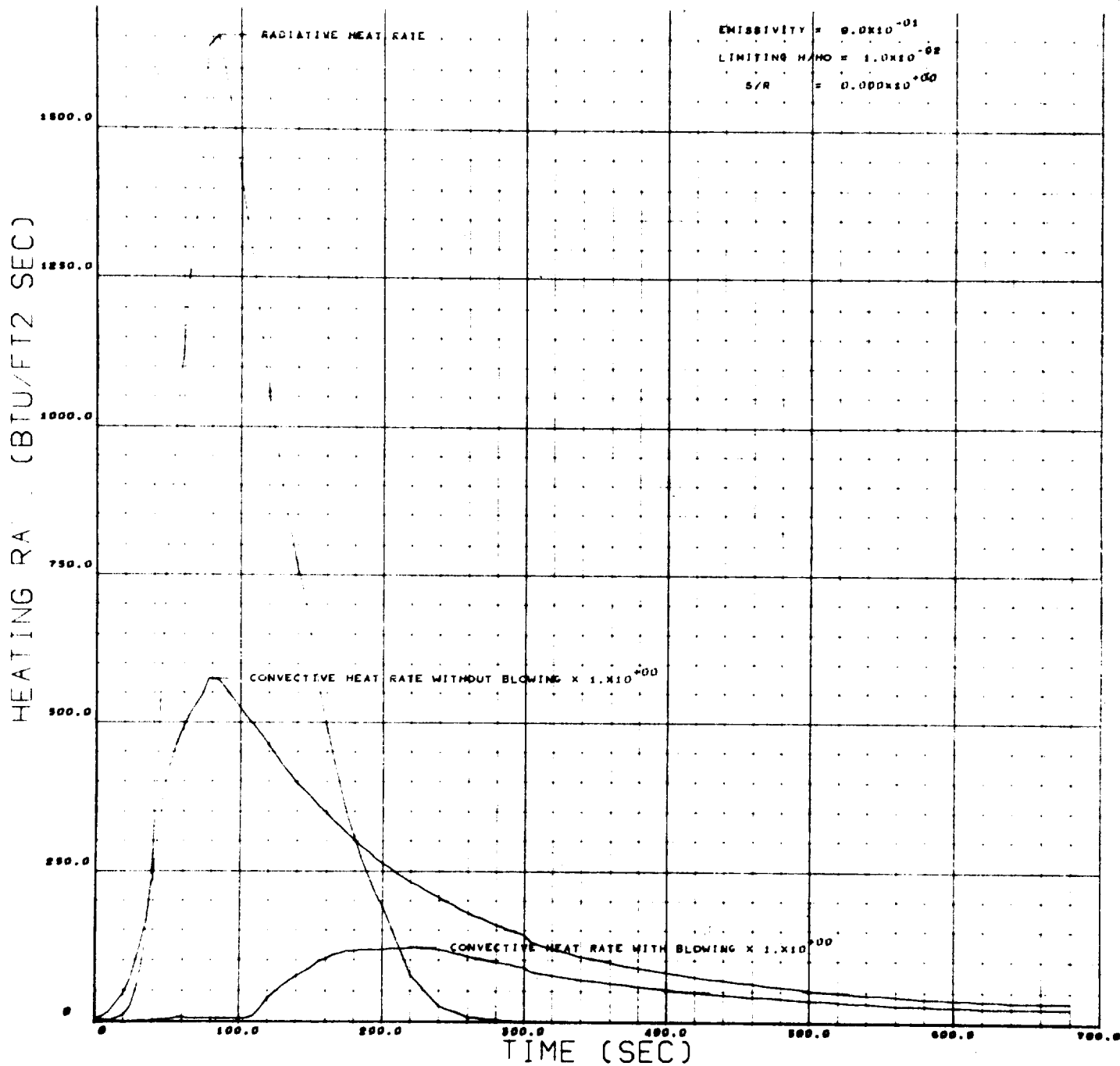


FIGURE A 61

MATERIAL RESPONSE DATA

APOLLO 50K UB

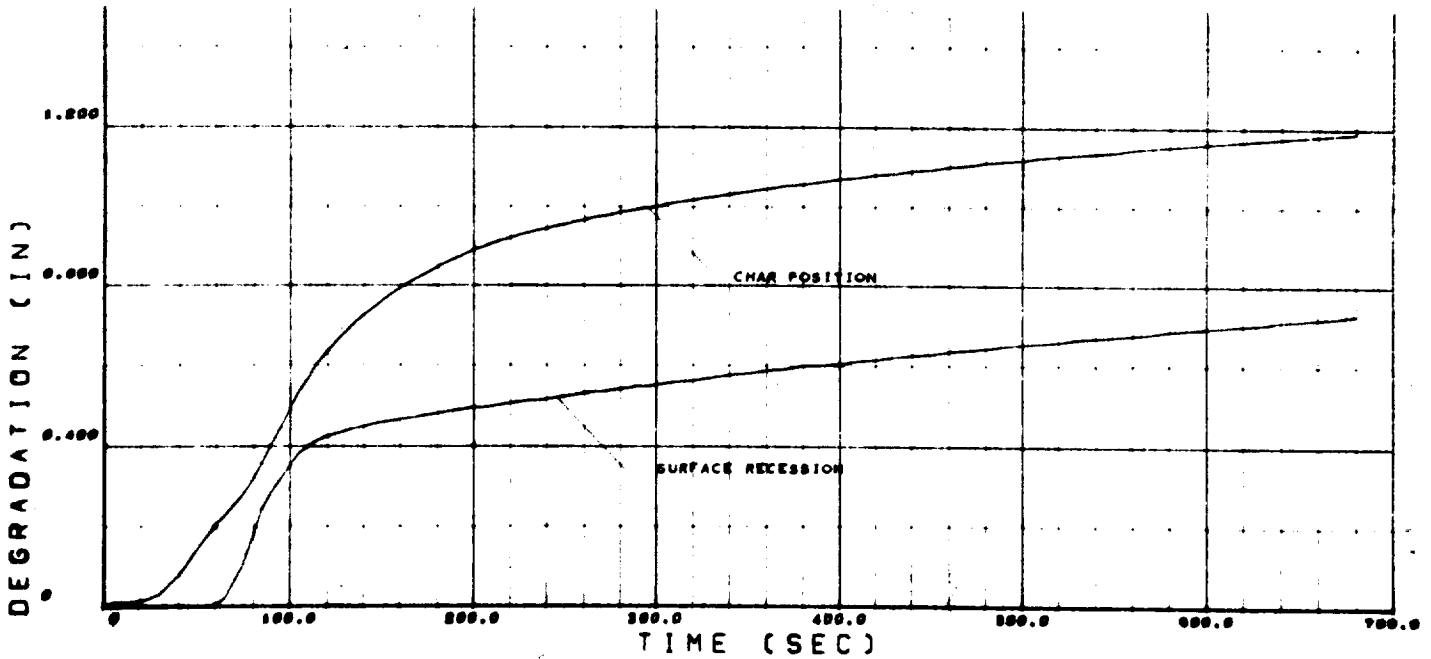
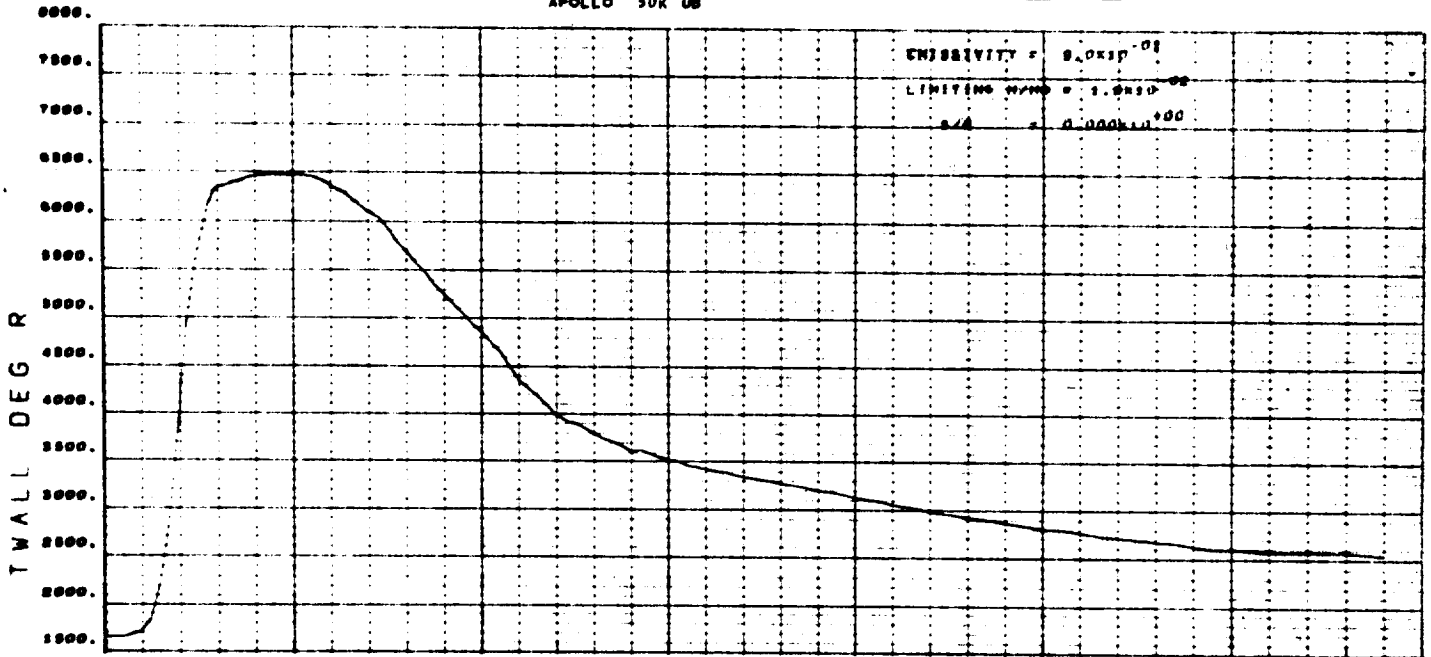


FIGURE A61

ENERGY ACCOMMODATION MECHANISMS

APOLLO 30K UB

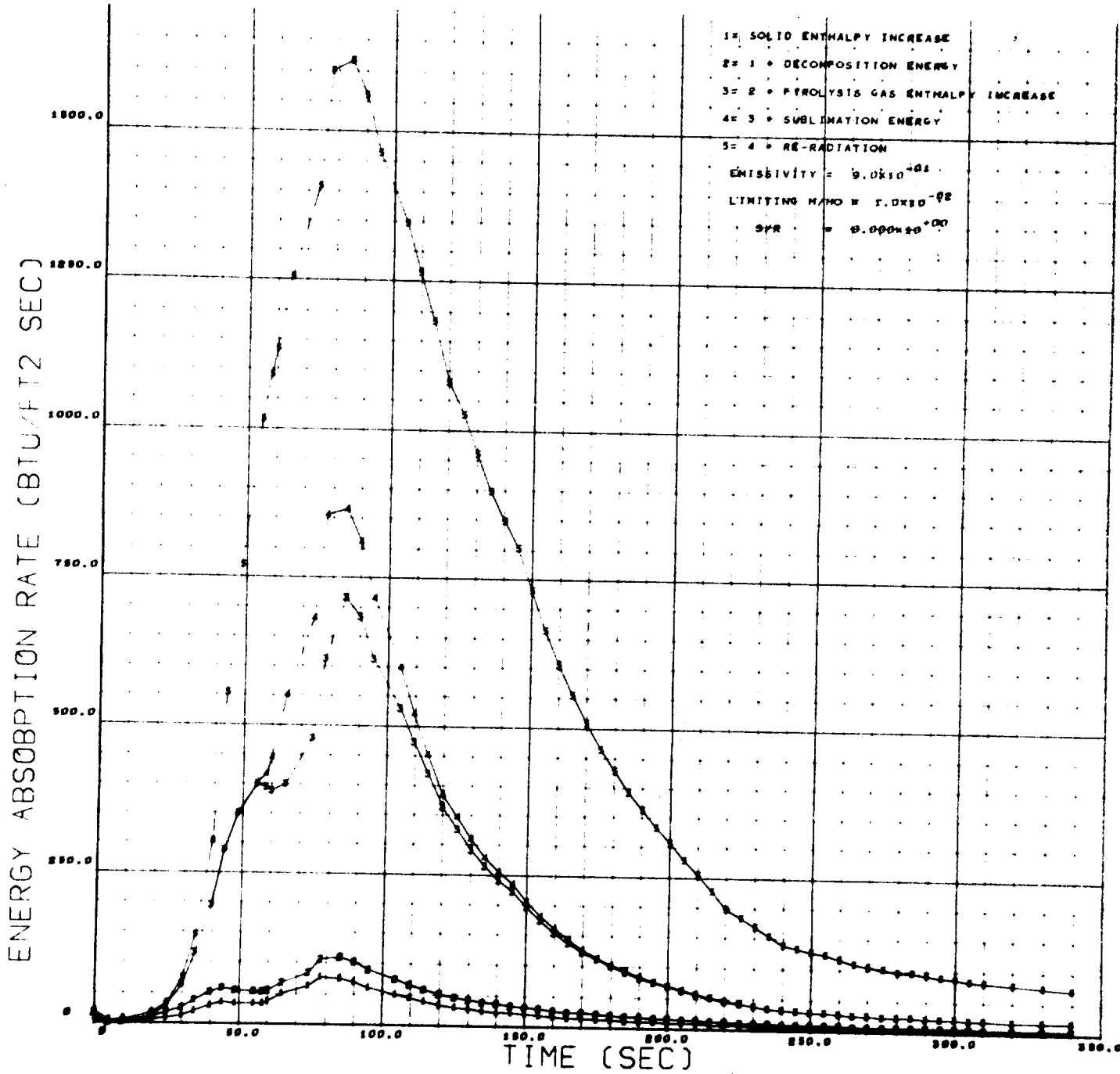


FIGURE A 62

HEATING RATE HISTORY

APOLLO 10K US

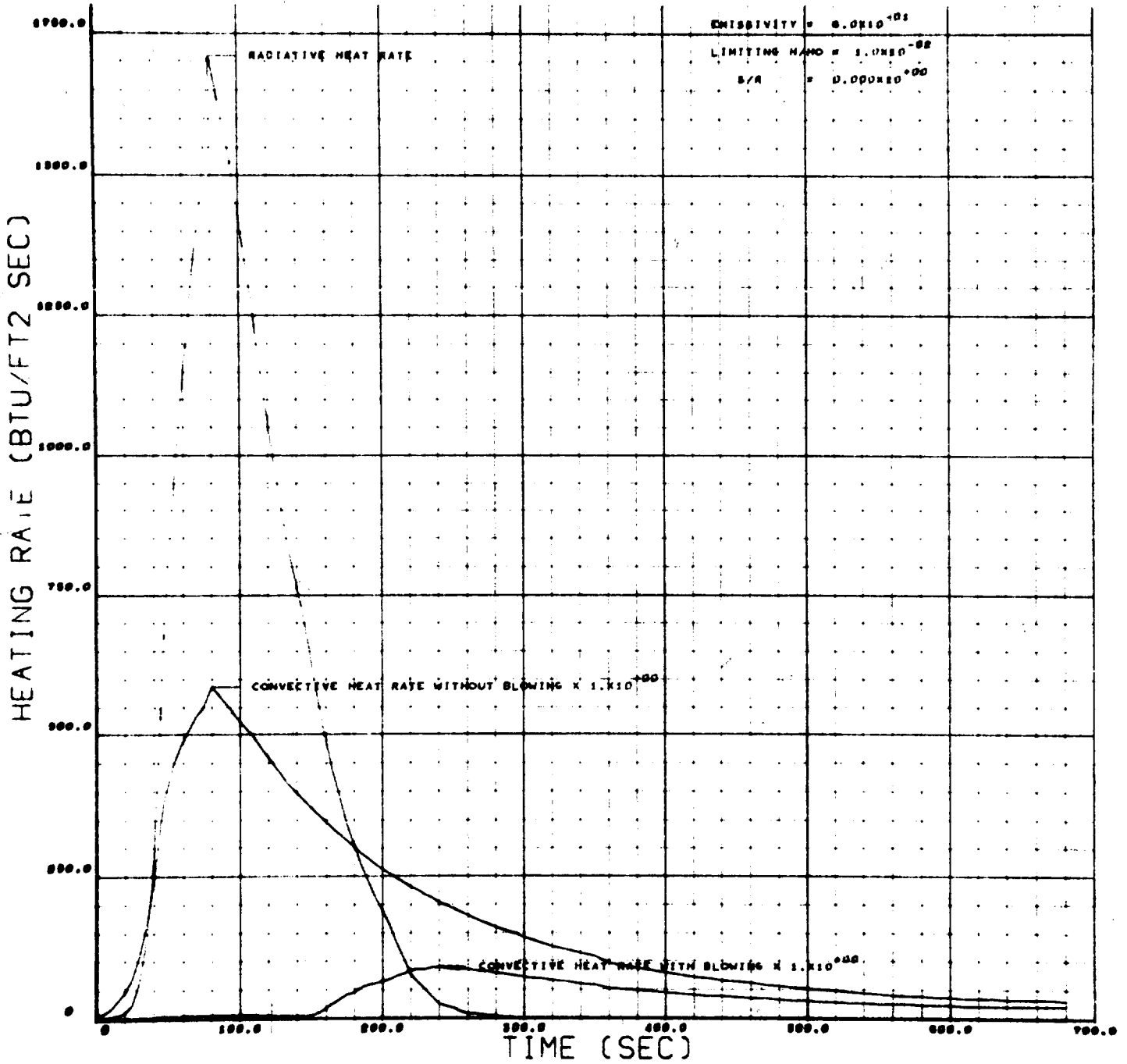


FIGURE A 62

MATERIAL RESPONSE DATA

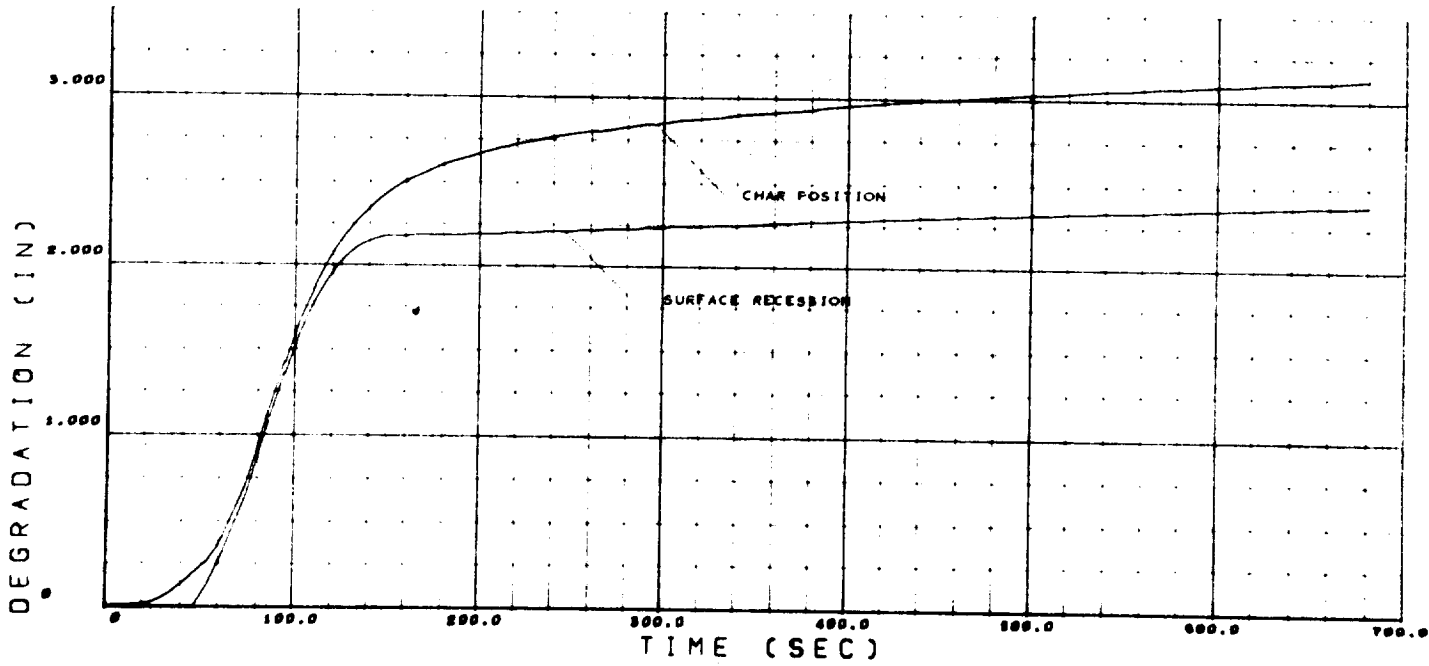
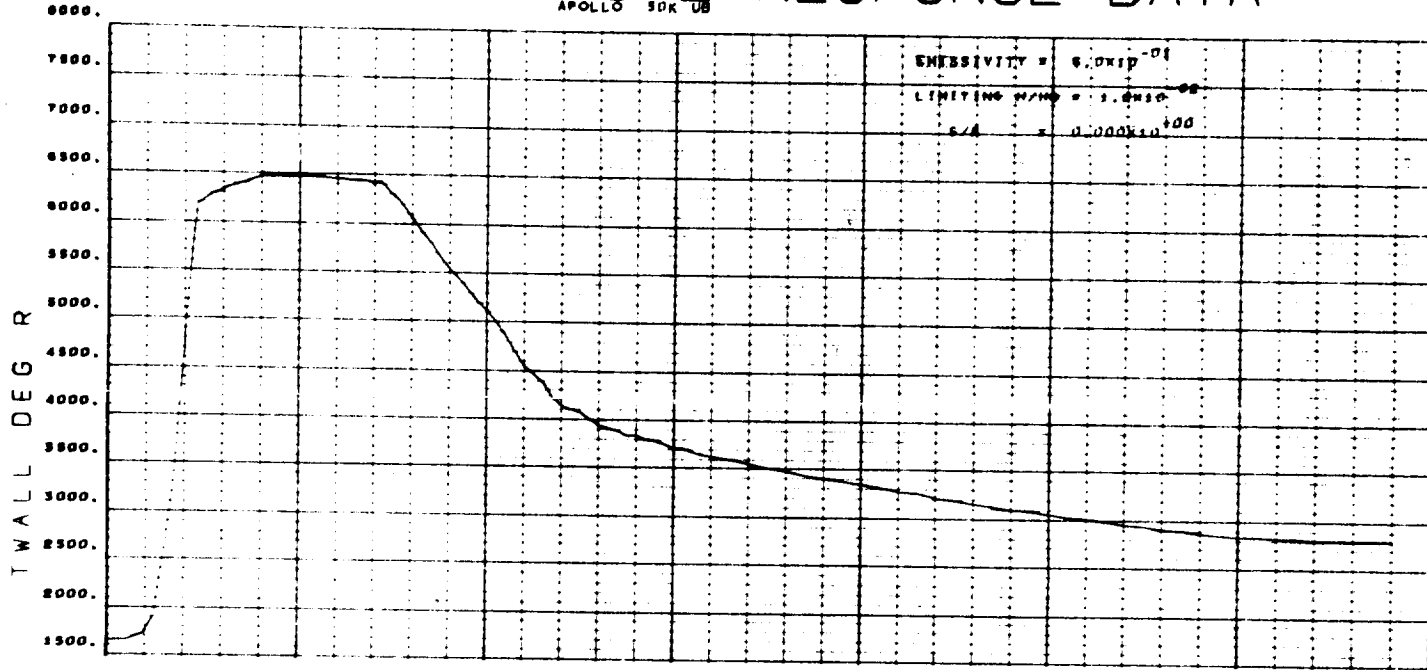


FIGURE A62

ENERGY ACCOMMODATION MECHANISMS

APOLLO 10X-68

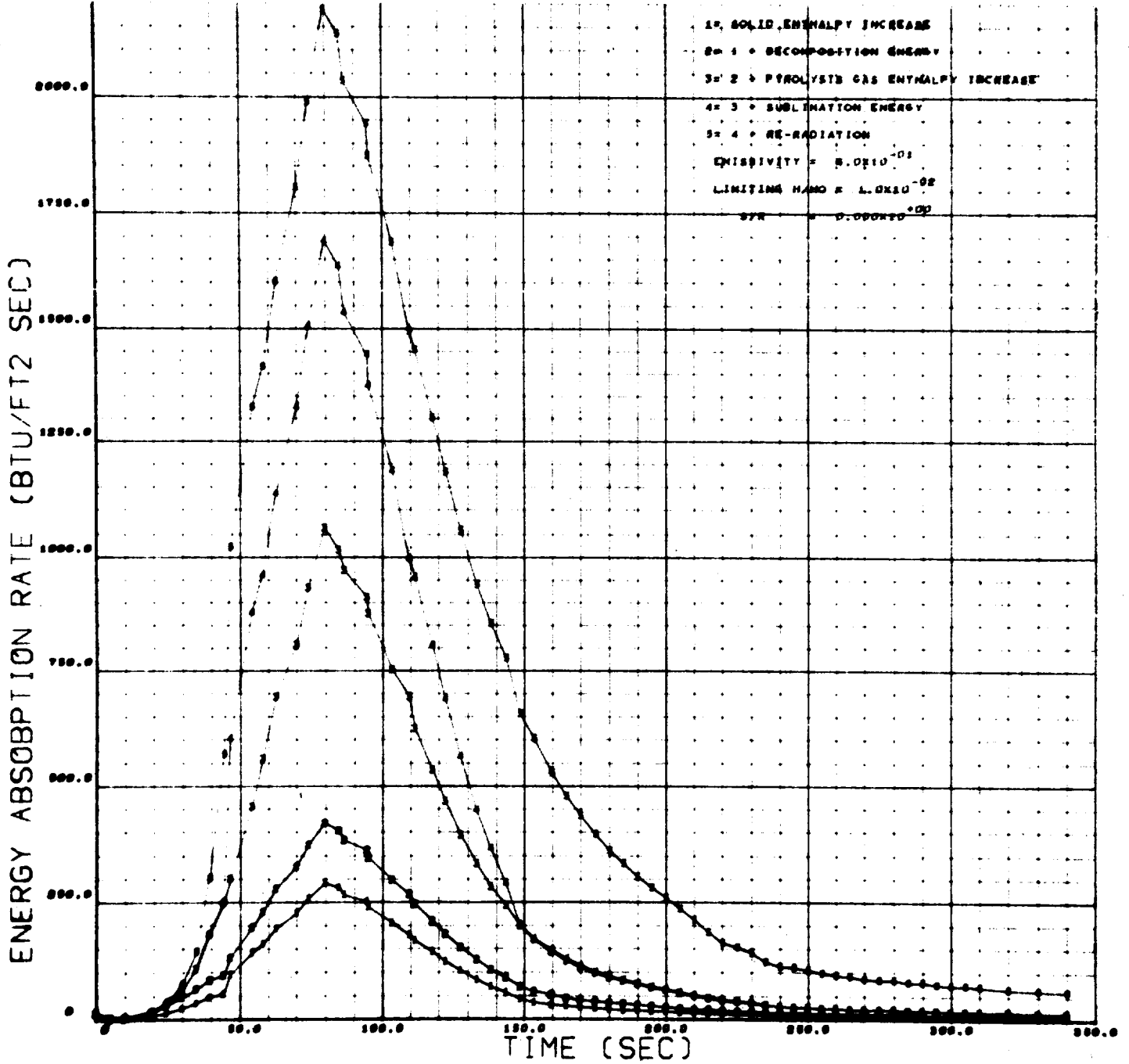


FIGURE A 63

HEATING RATE HISTORY

APOLLO 30K US

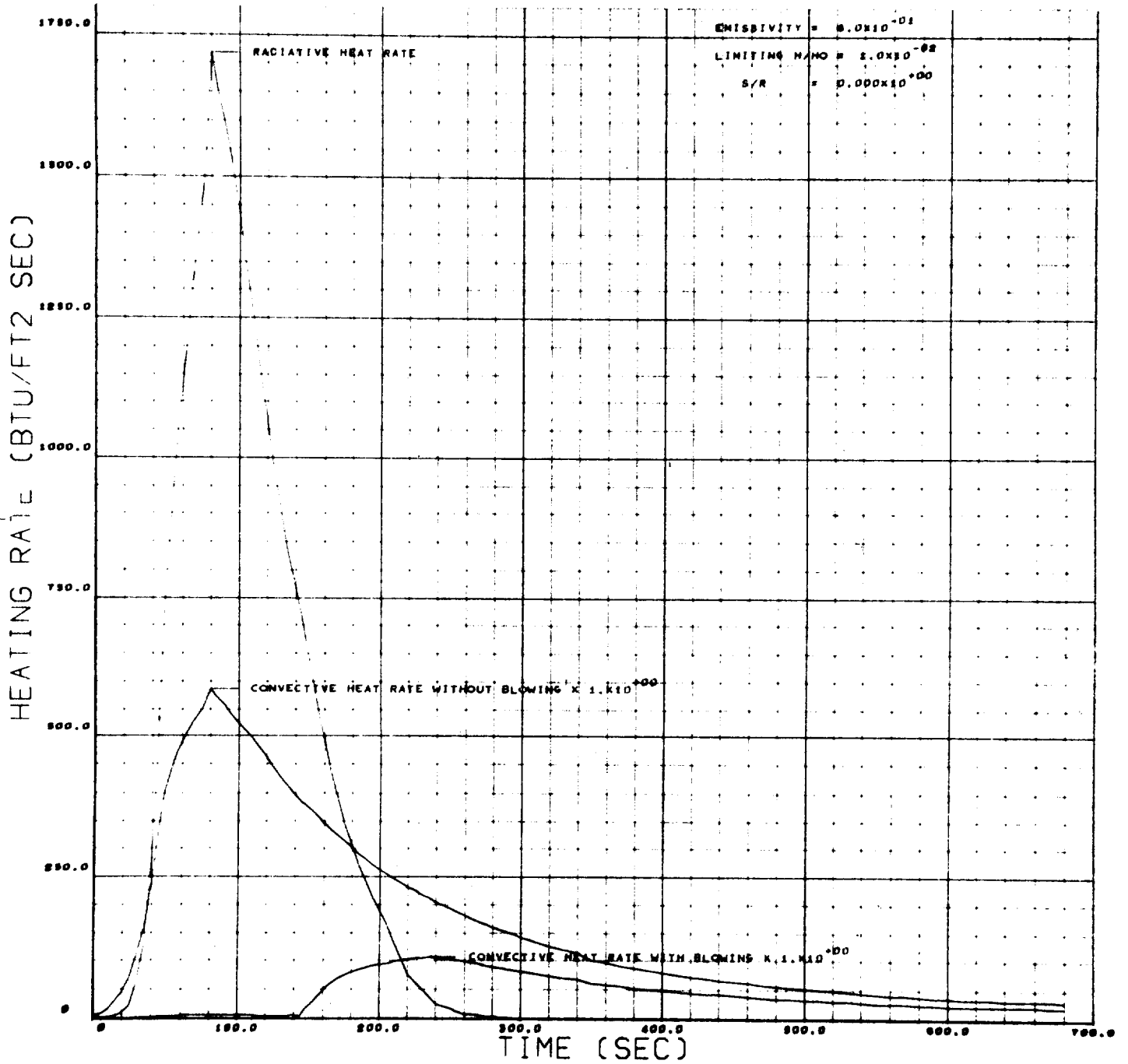


FIGURE A 63

MATERIAL RESPONSE DATA

APOLLO 50X 08

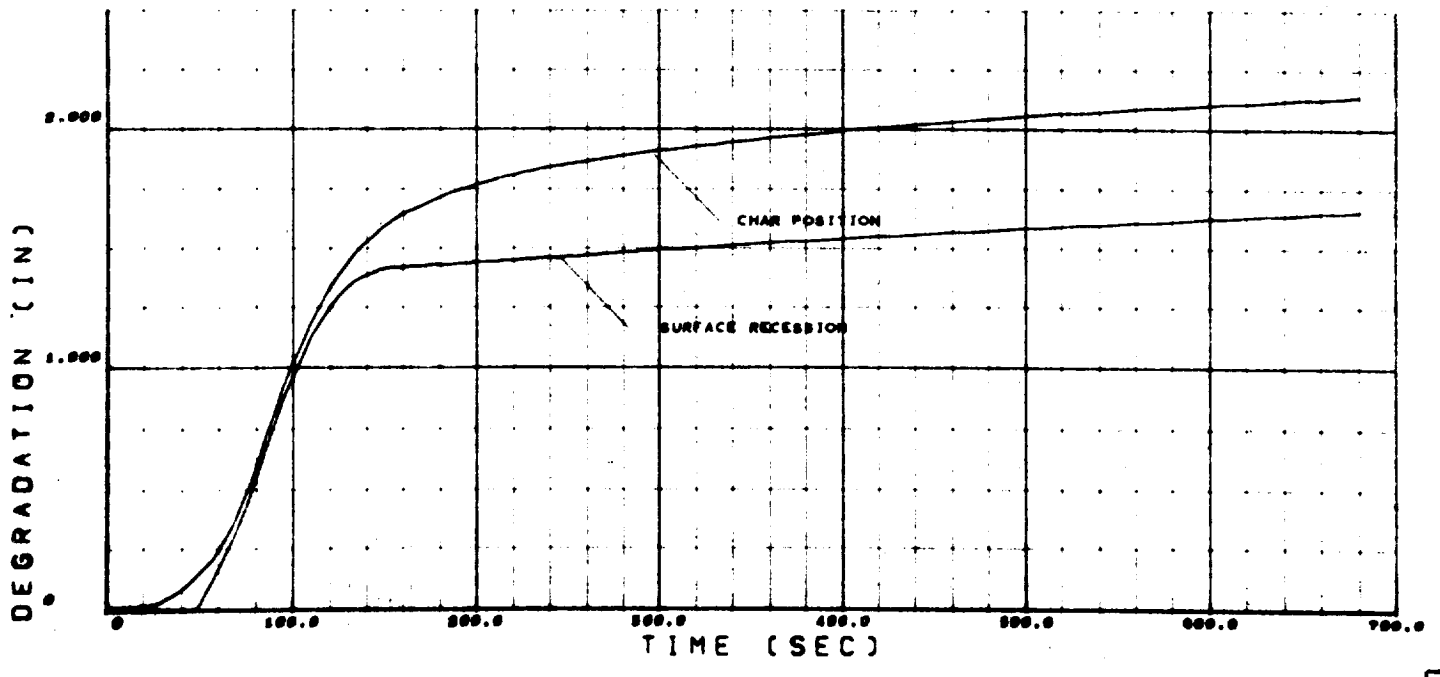
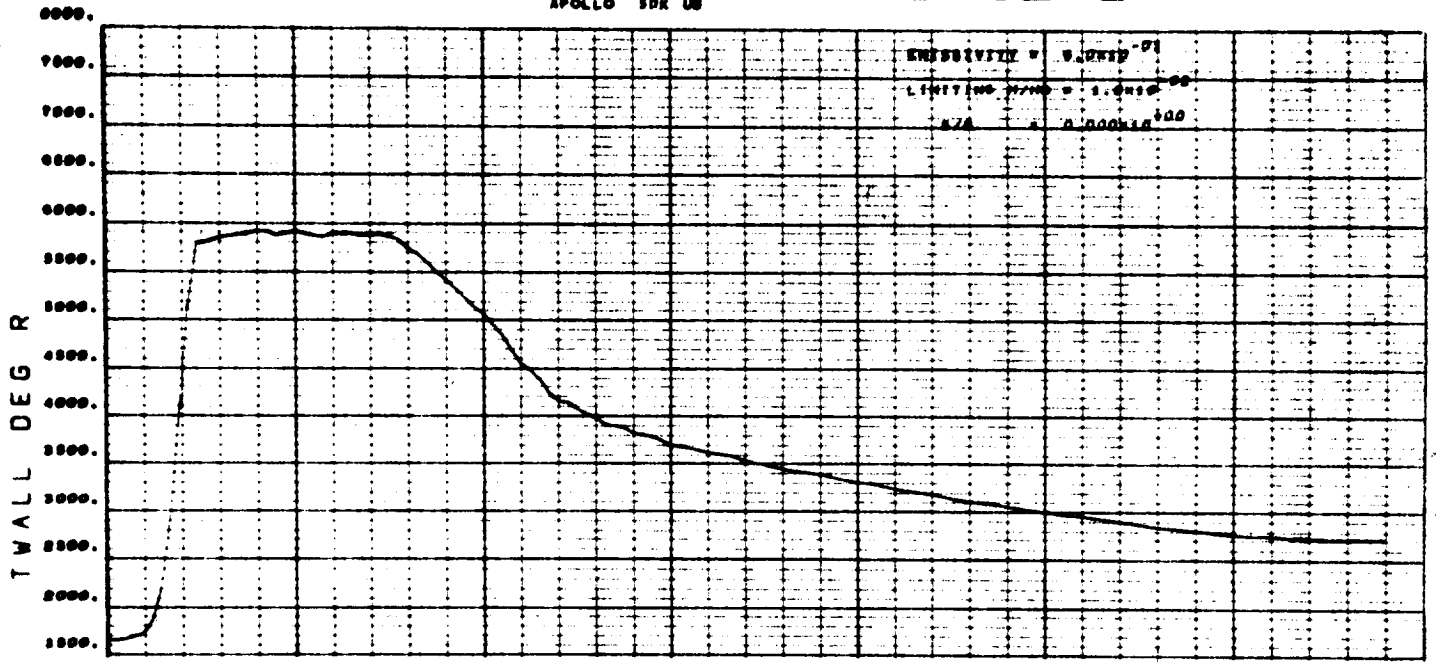


FIGURE A63

ENERGY ACCOMMODATION MECHANISMS

APOLLO 10K LB

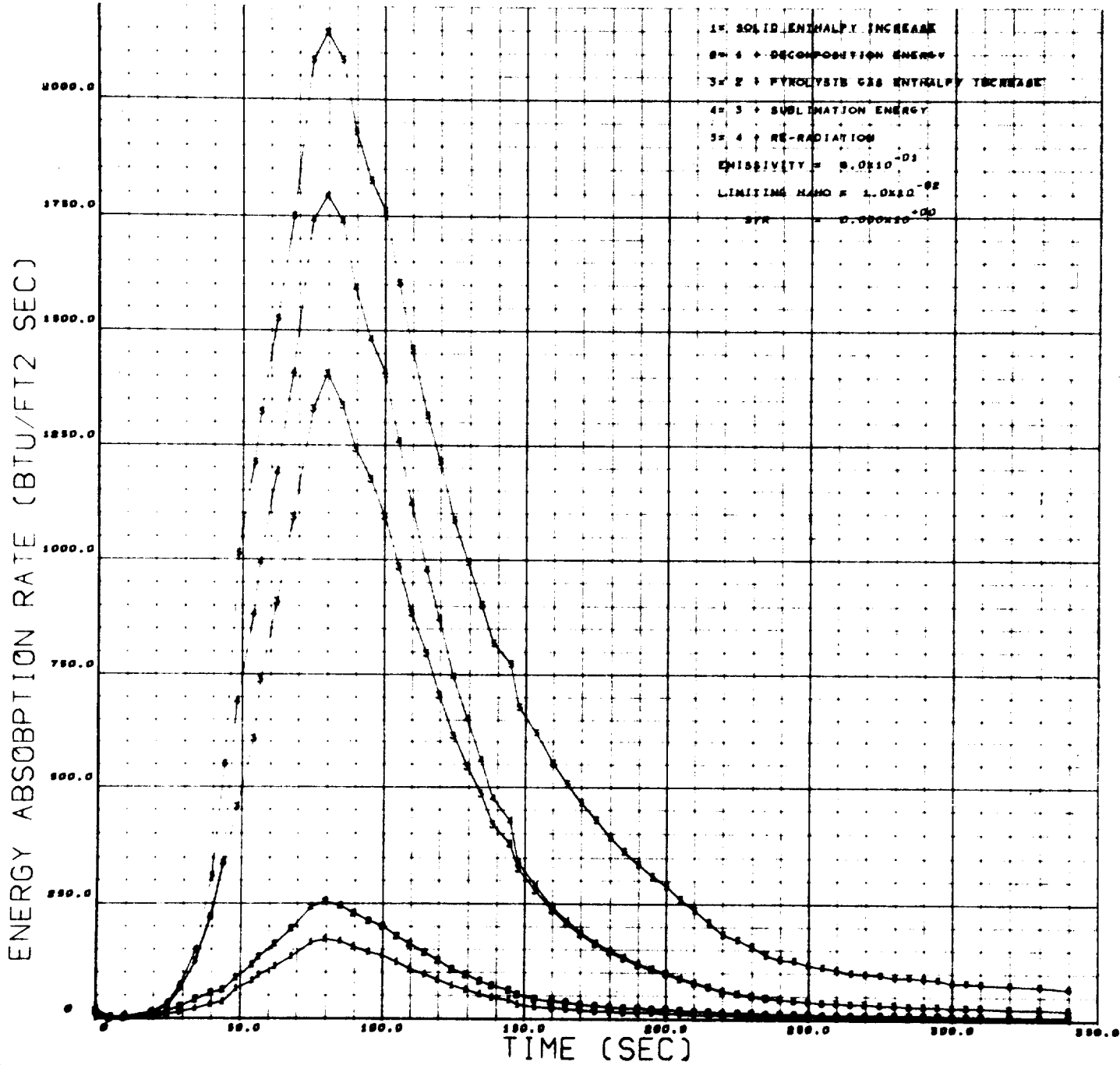


FIGURE A 64

HEATING RATE HISTORY

APOLLO 30K US

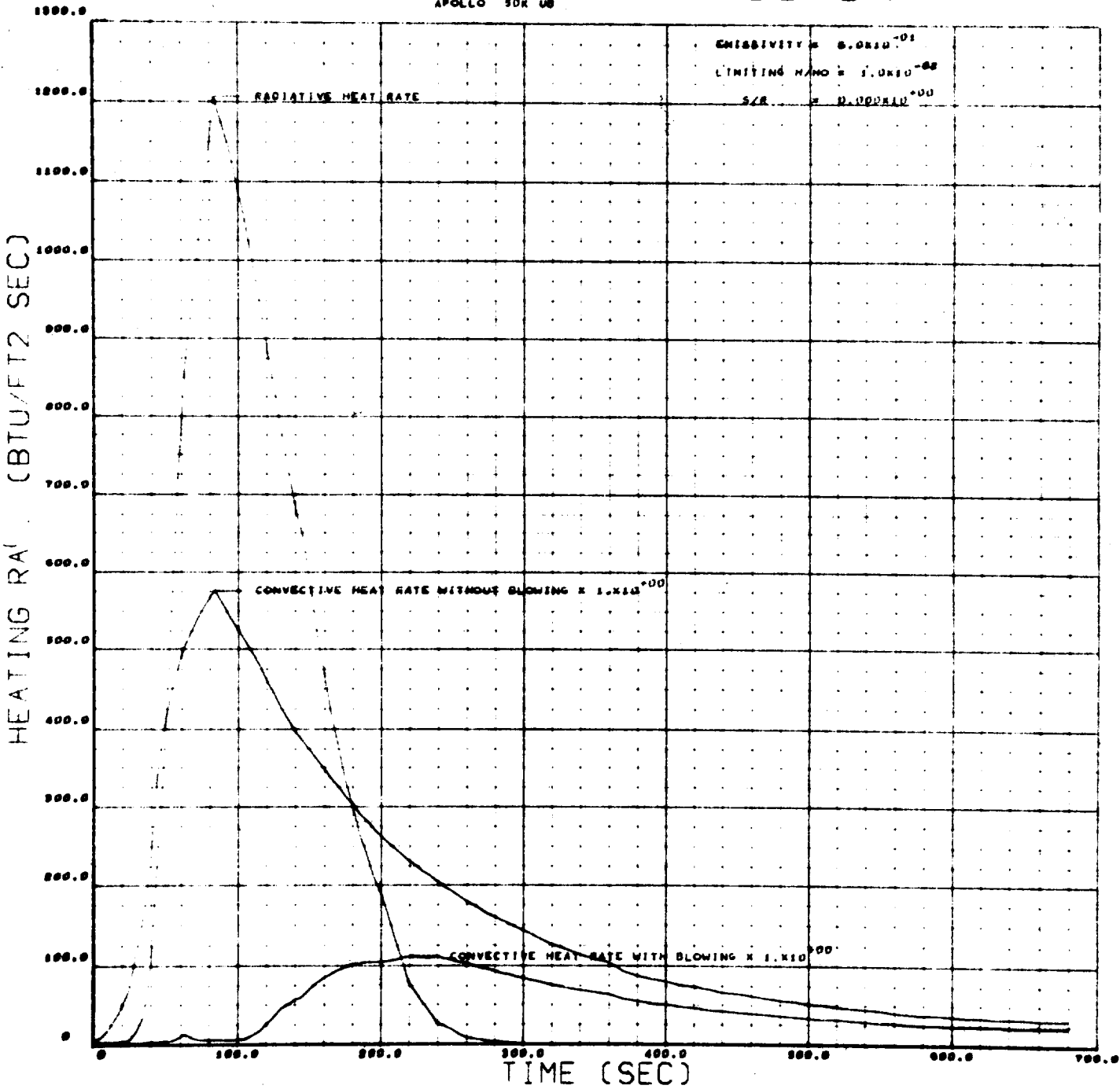


FIGURE A 64

MATERIAL RESPONSE DATA

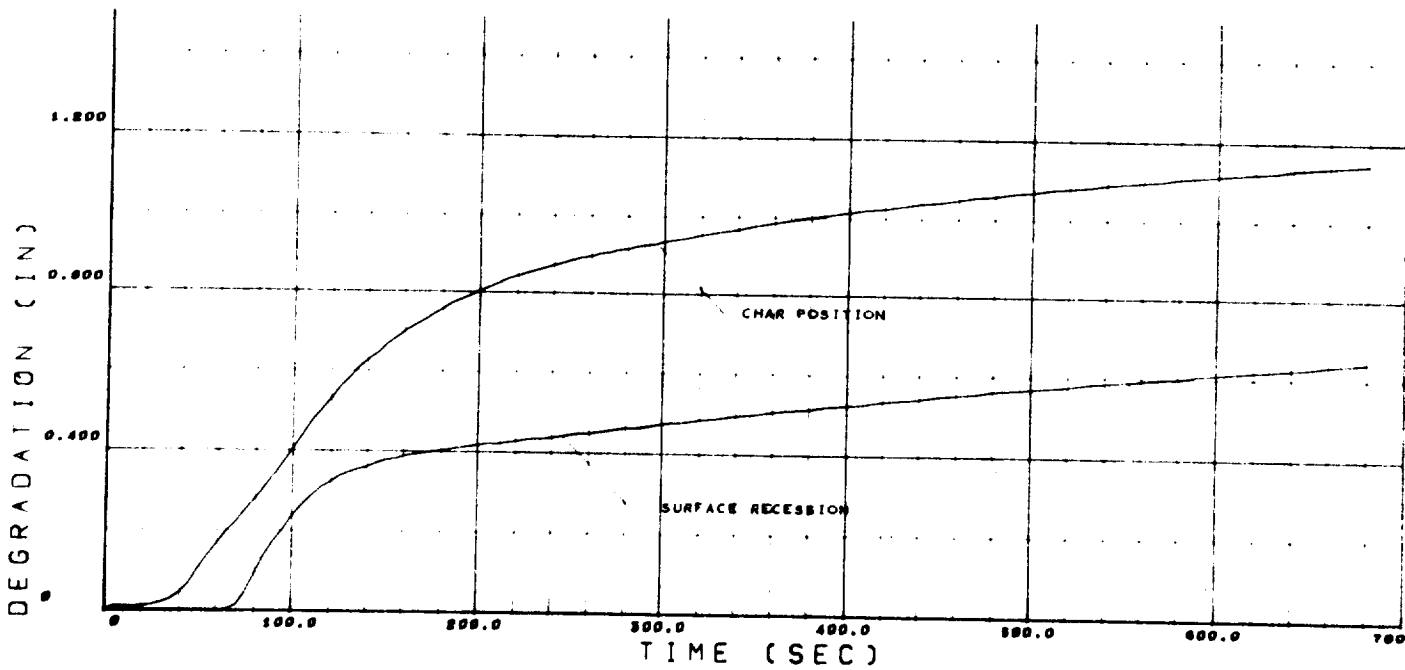
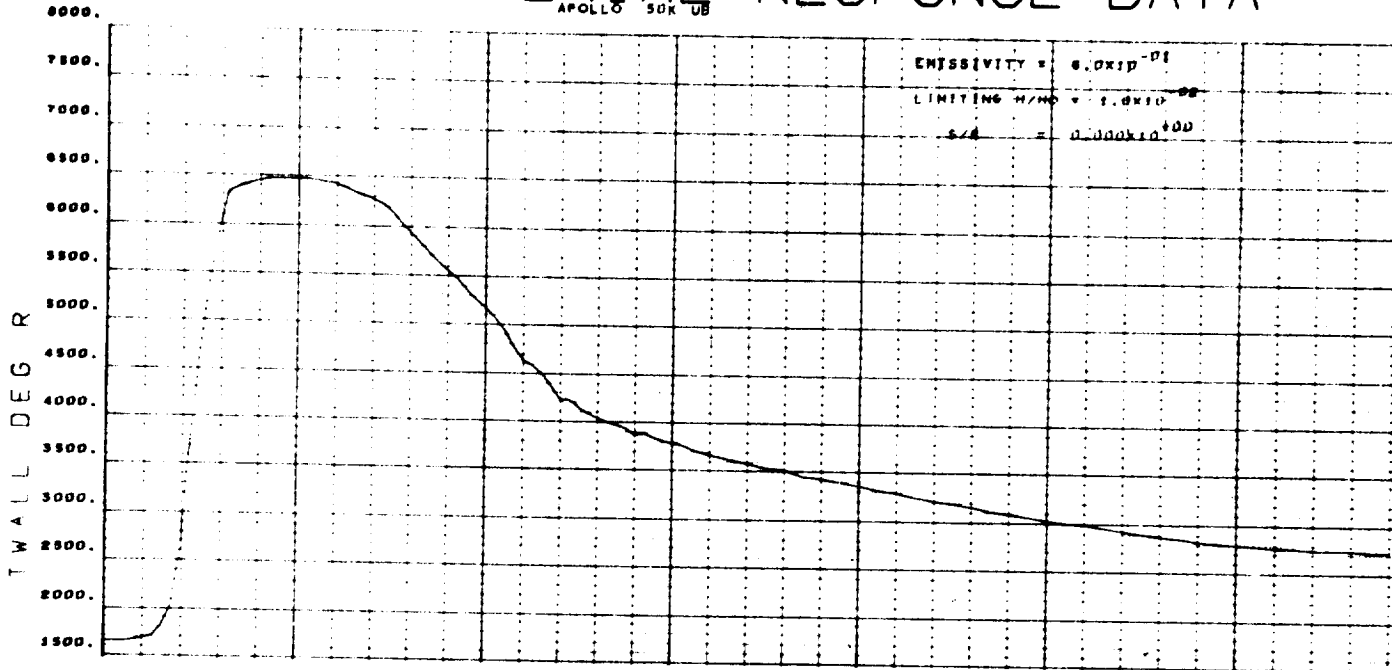


FIGURE A 61

ENERGY ACCOMMODATION MECHANISMS

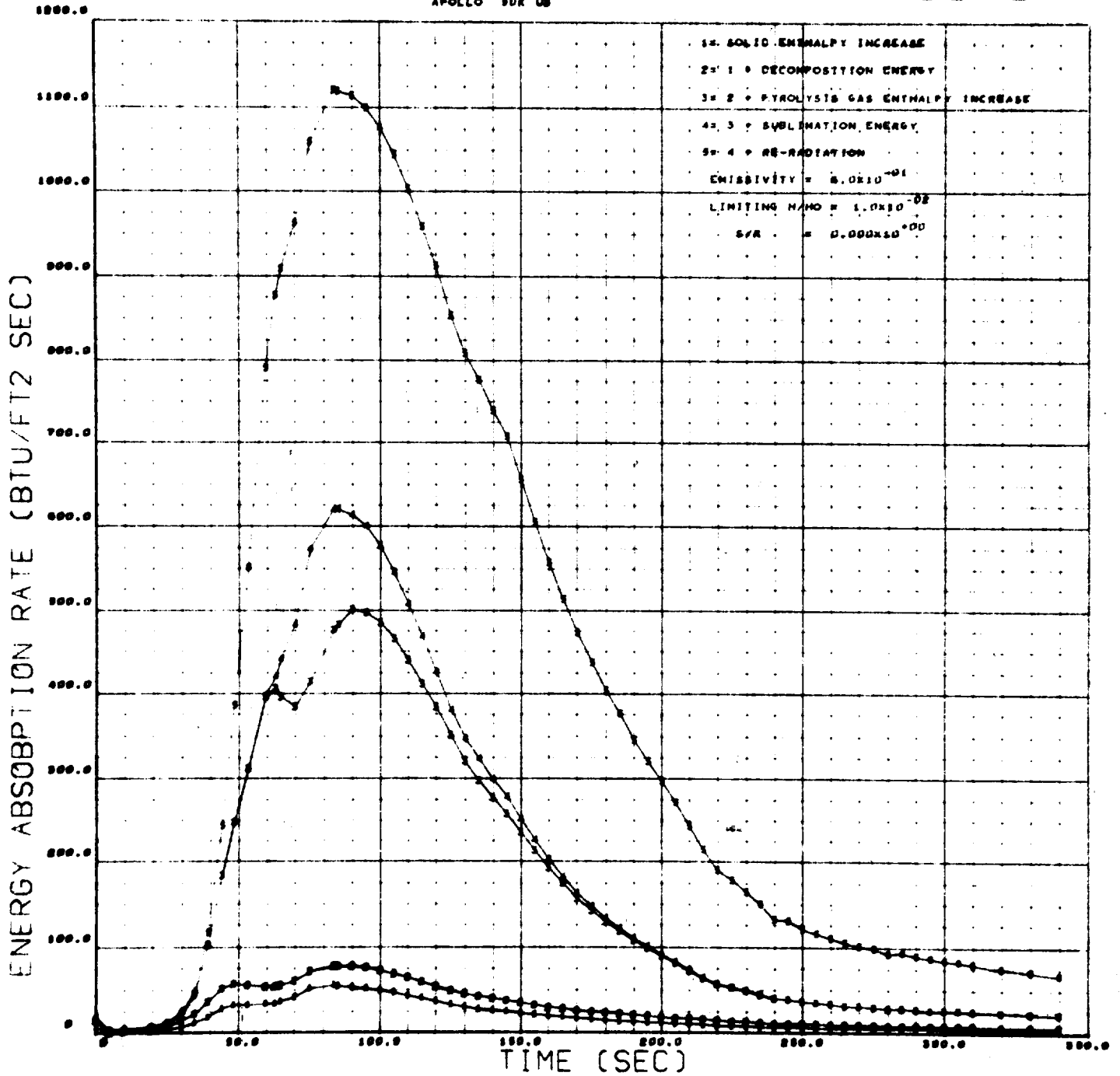


FIGURE A 65

HEATING RATE HISTORY

APOLLO 30K UB

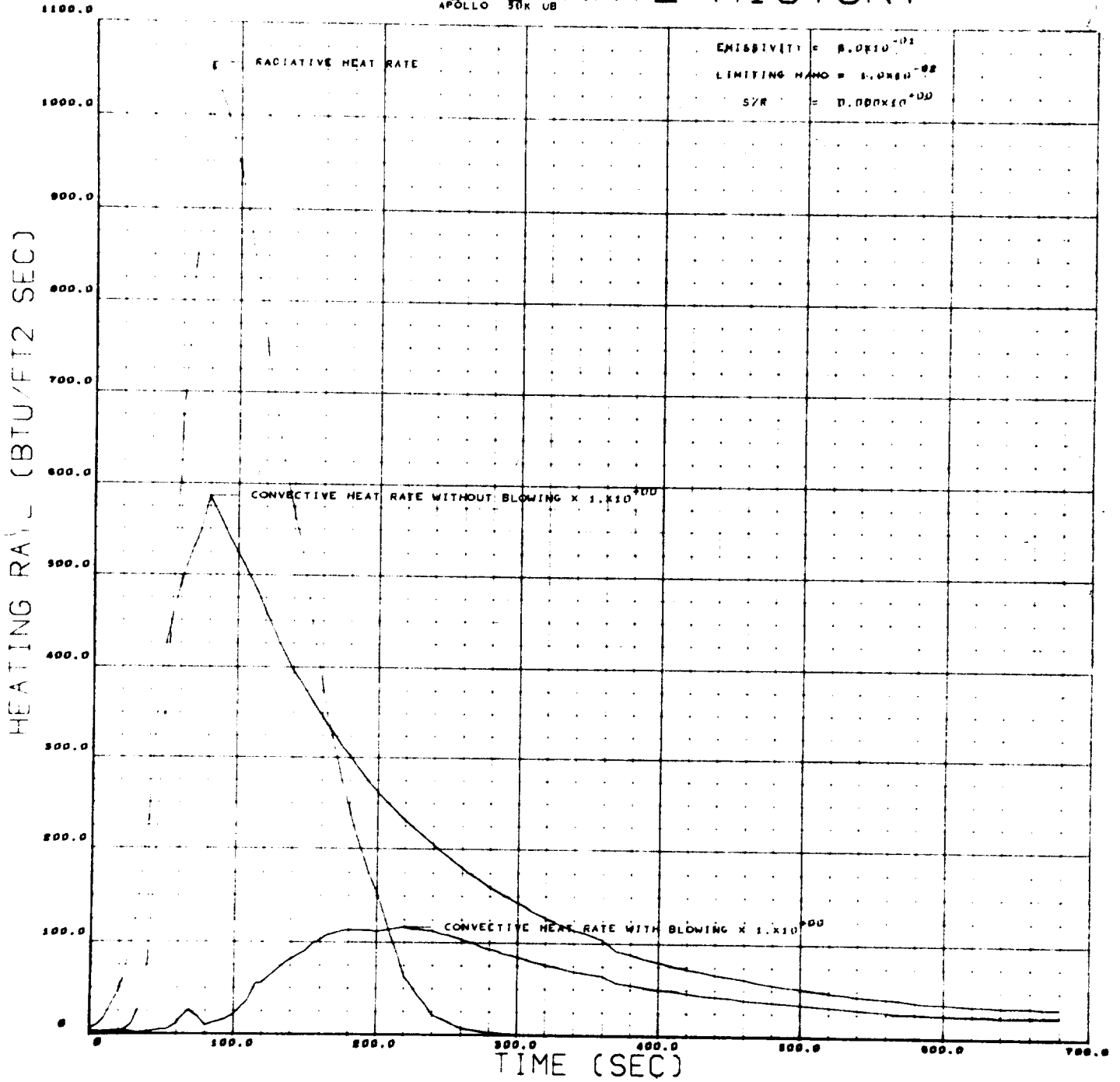


FIGURE A65

MATERIAL RESPONSE DATA

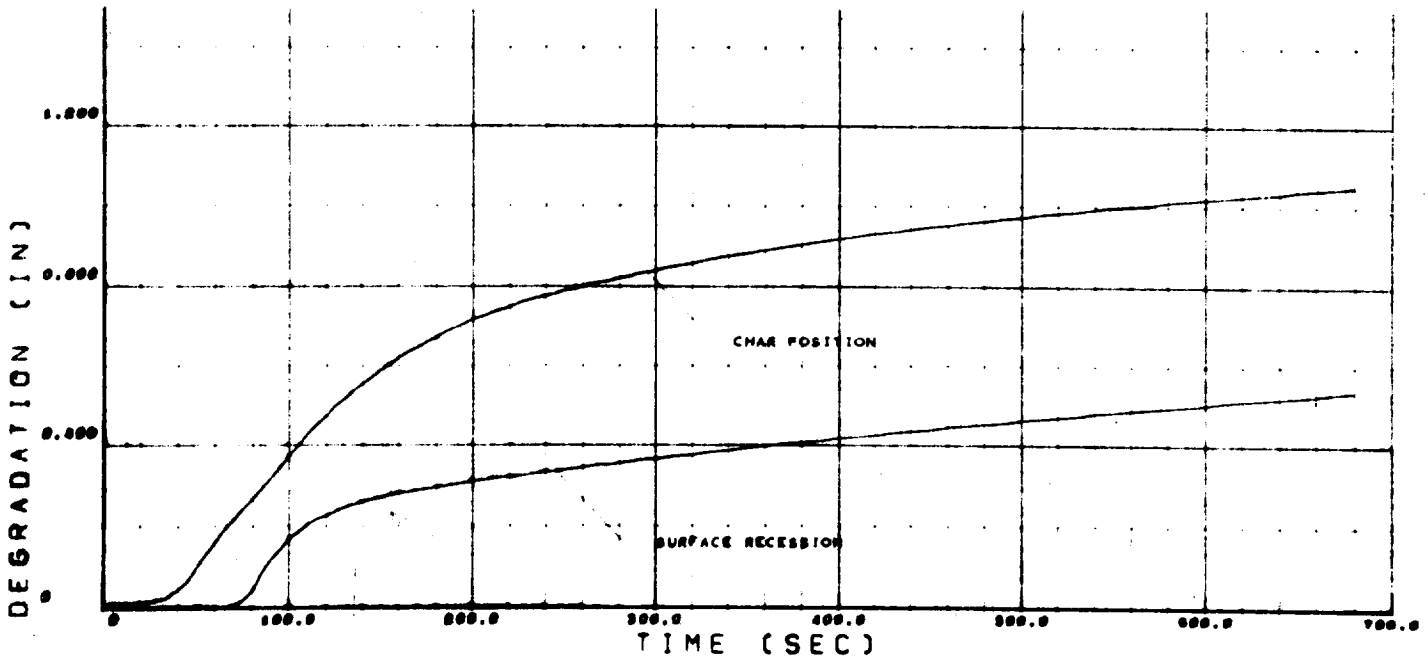
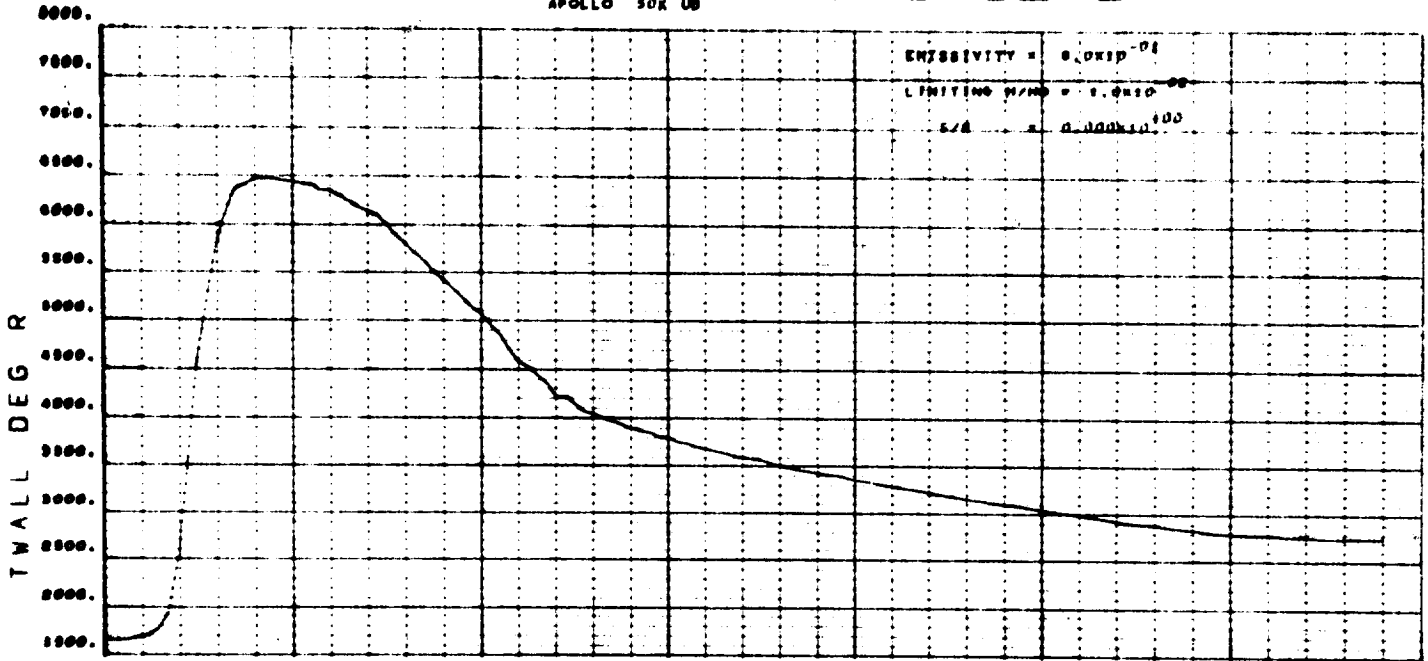


FIGURE A65

ENERGY ACCOMMODATION MECHANISMS

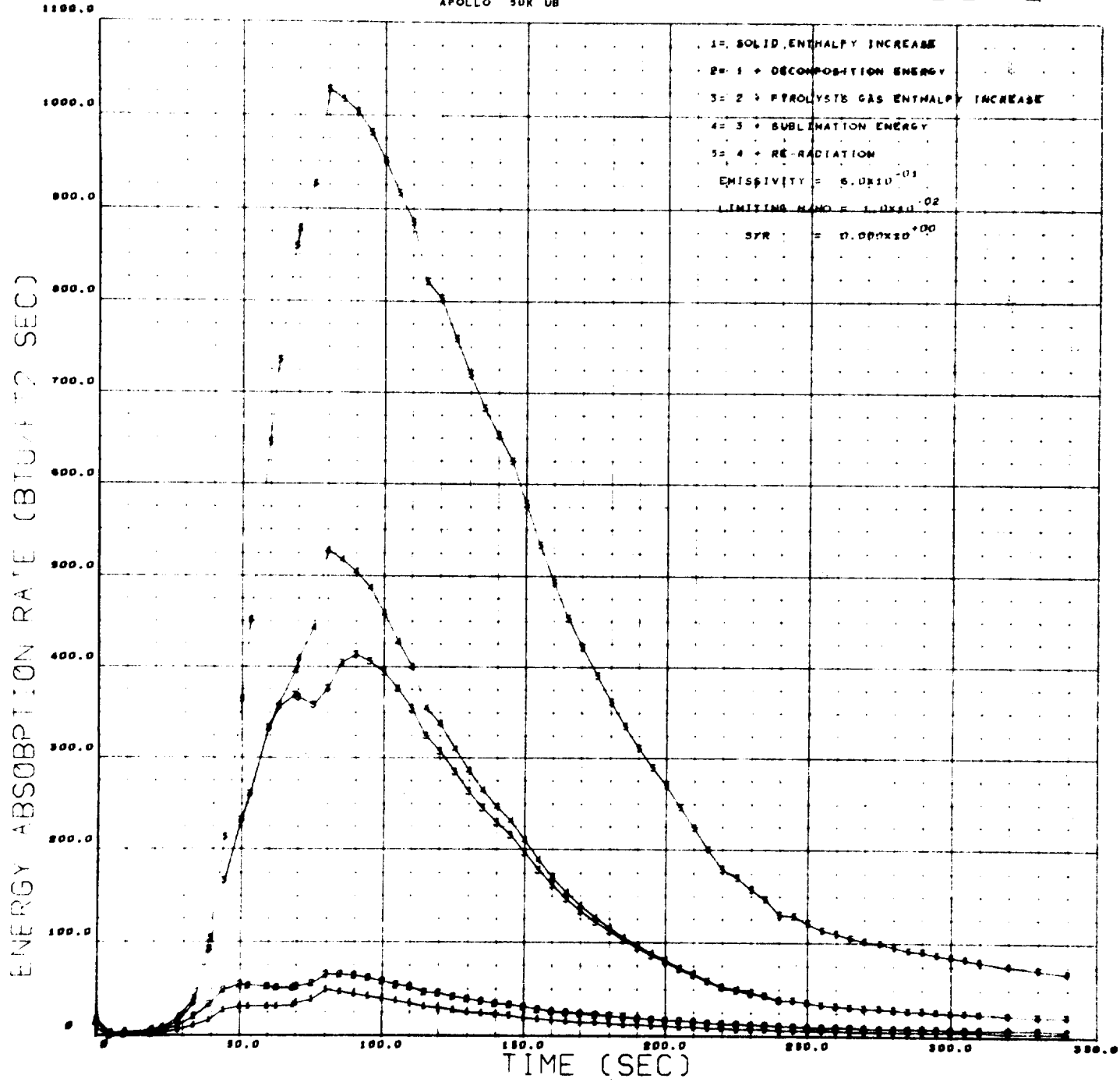


FIGURE A 66

HEATING RATE HISTORY

APOLLO 30K US

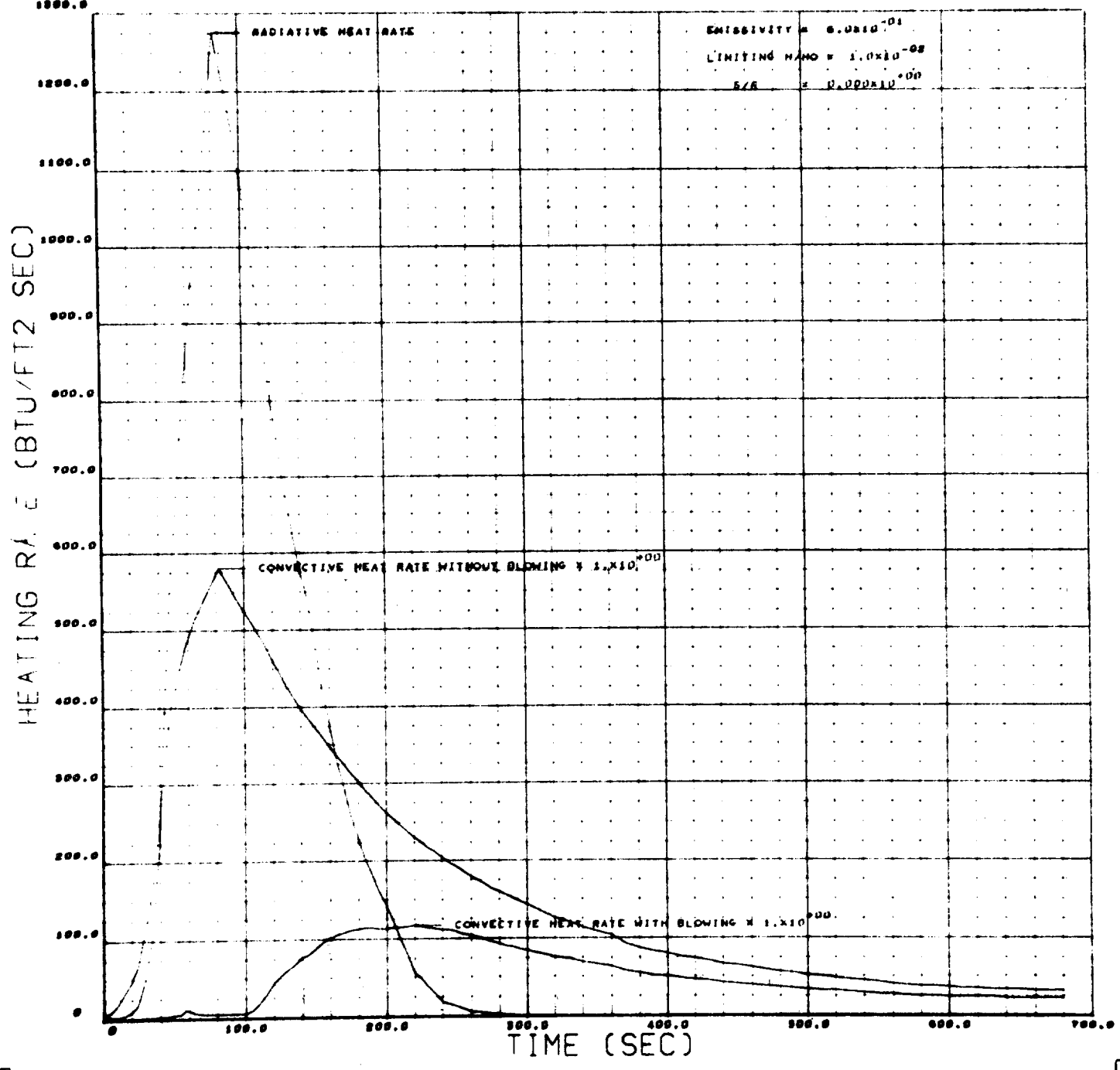


FIGURE A 66

MATERIAL RESPONSE DATA

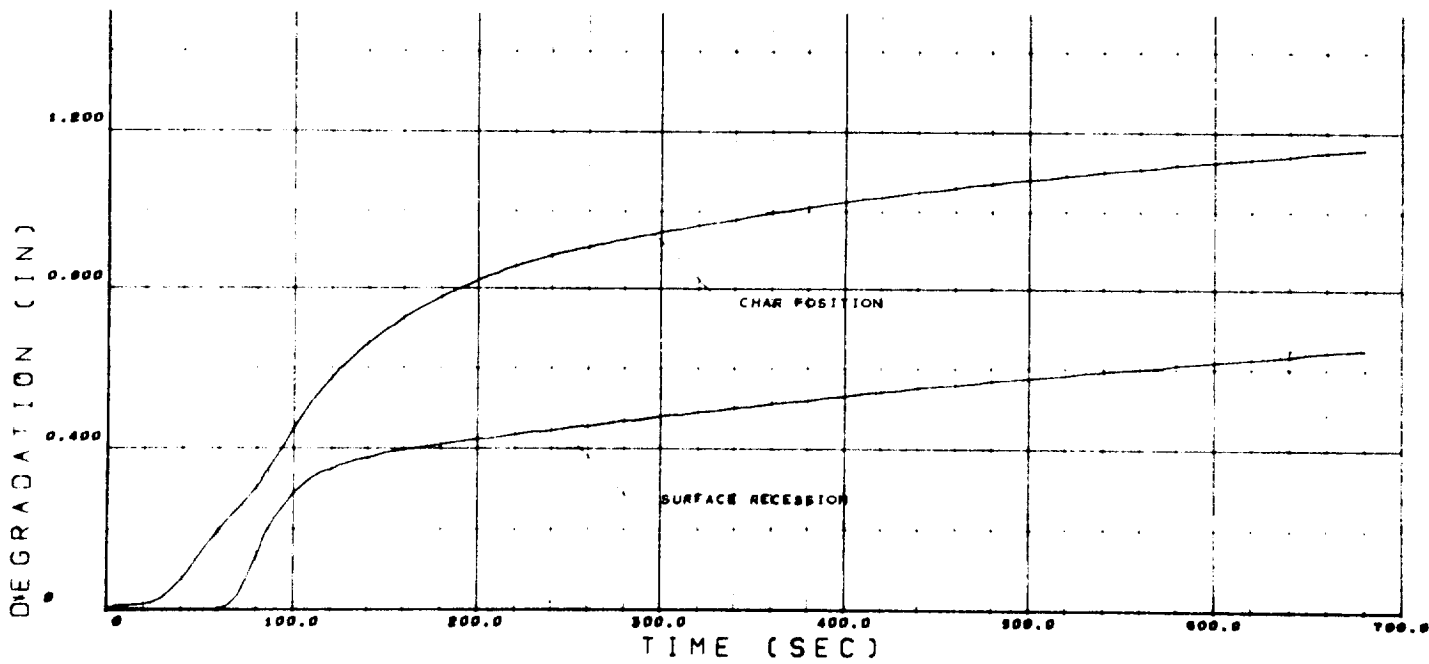
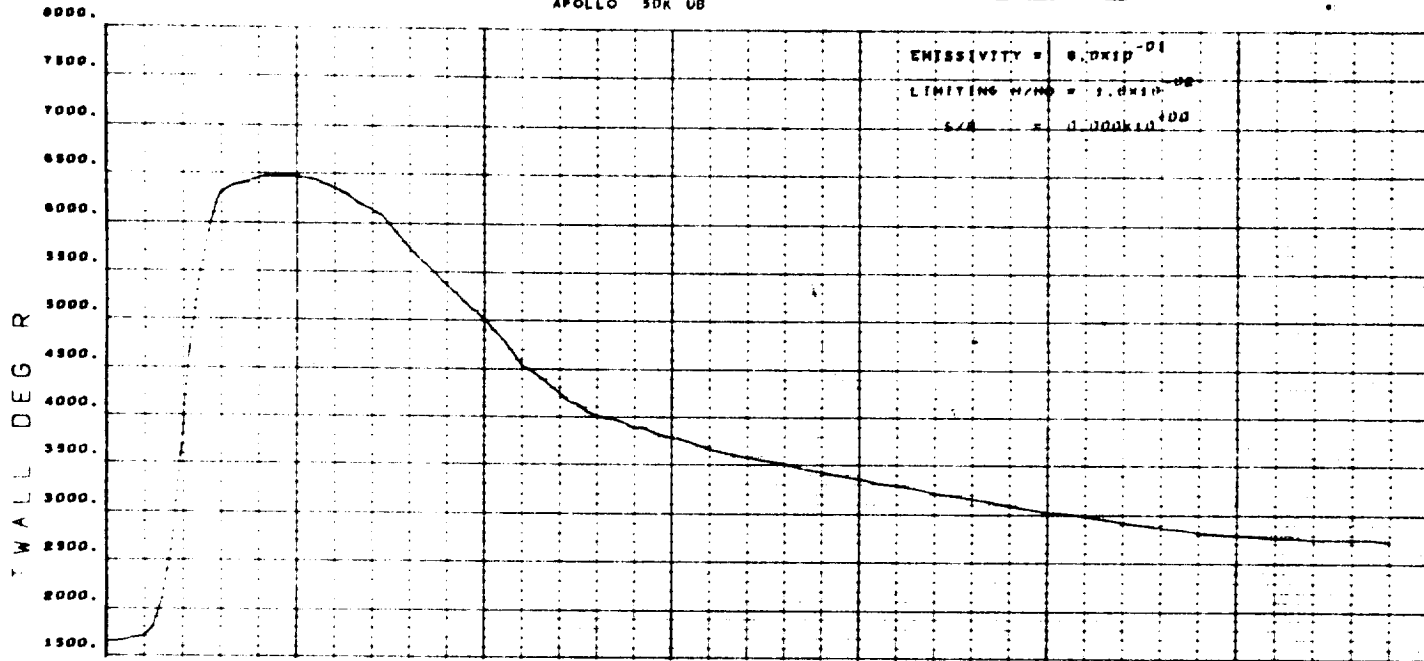


FIGURE A66

ENERGY ACCOMMODATION MECHANISMS

APOLLO SUR US

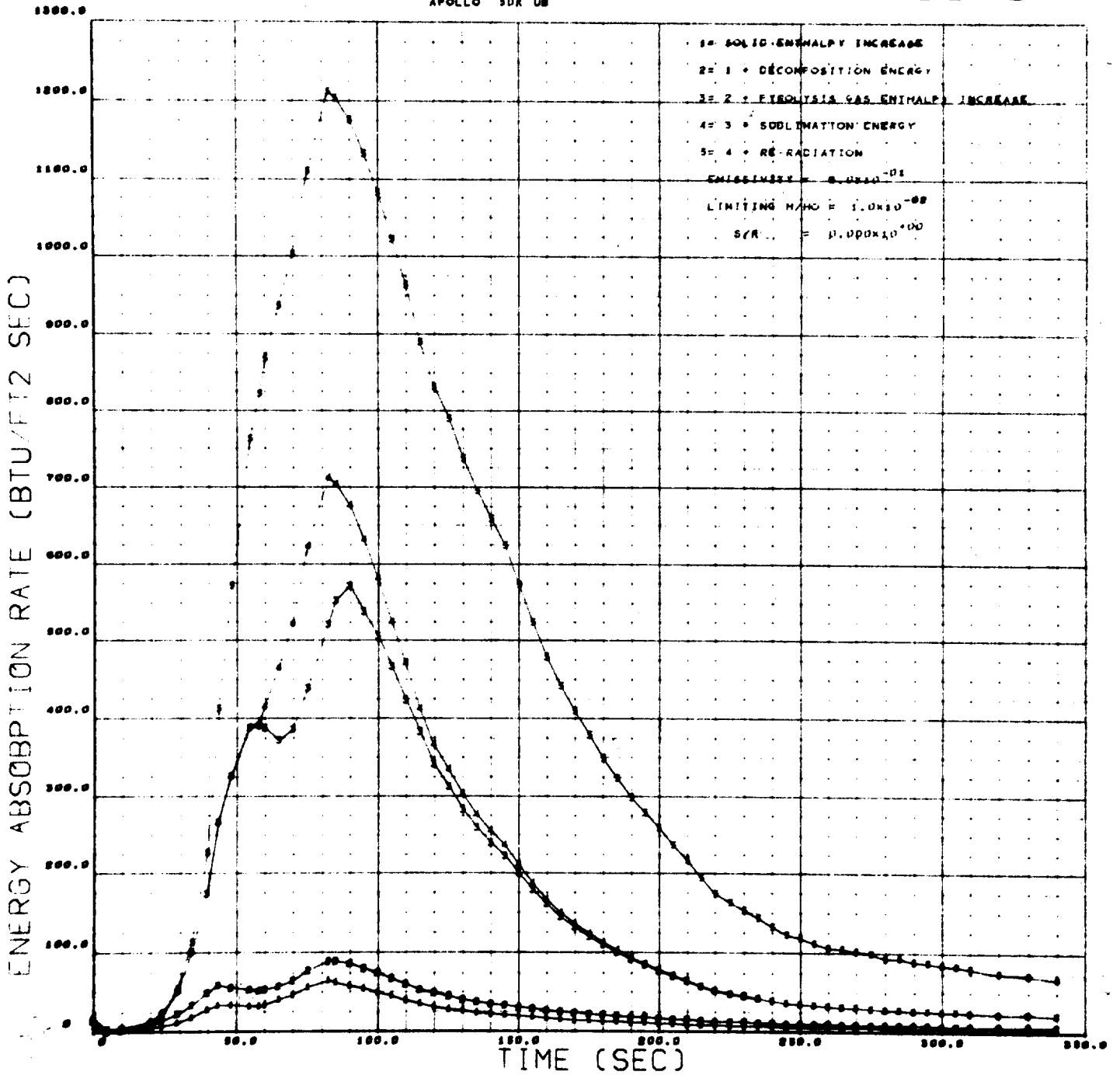


FIGURE A 67

HEATING RATE HISTORY

APOLLO 30K UB

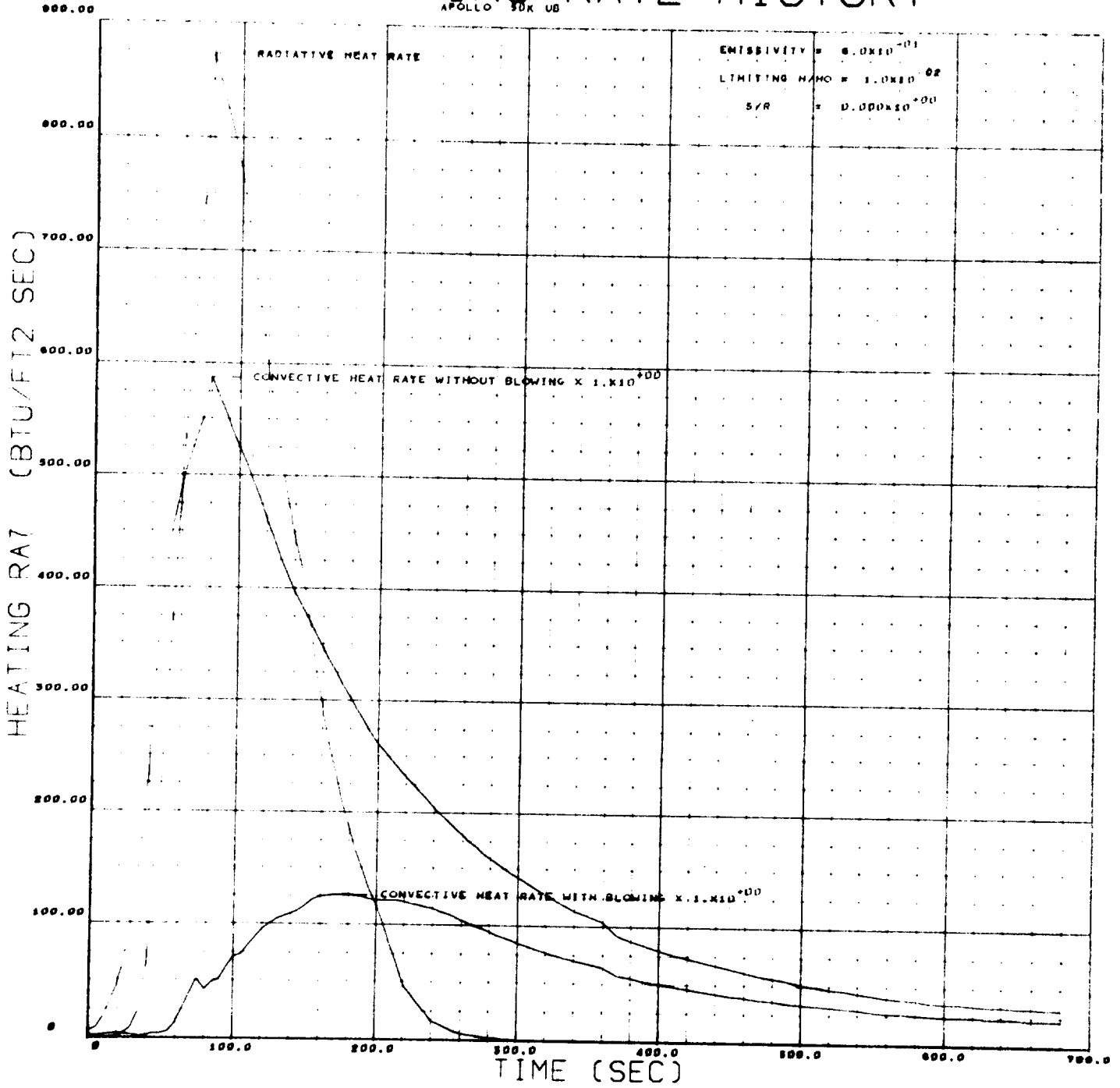


FIGURE A 67

MATERIAL RESPONSE DATA

APOLLO 50K US

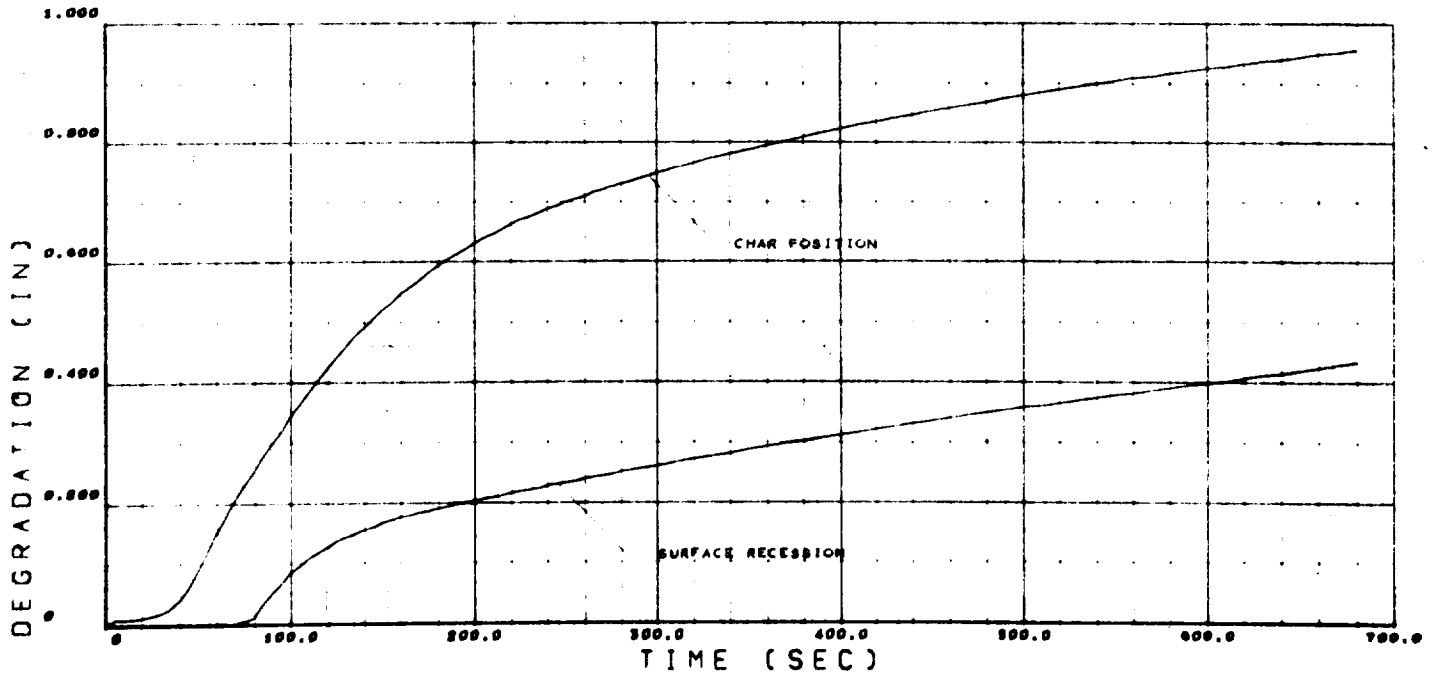
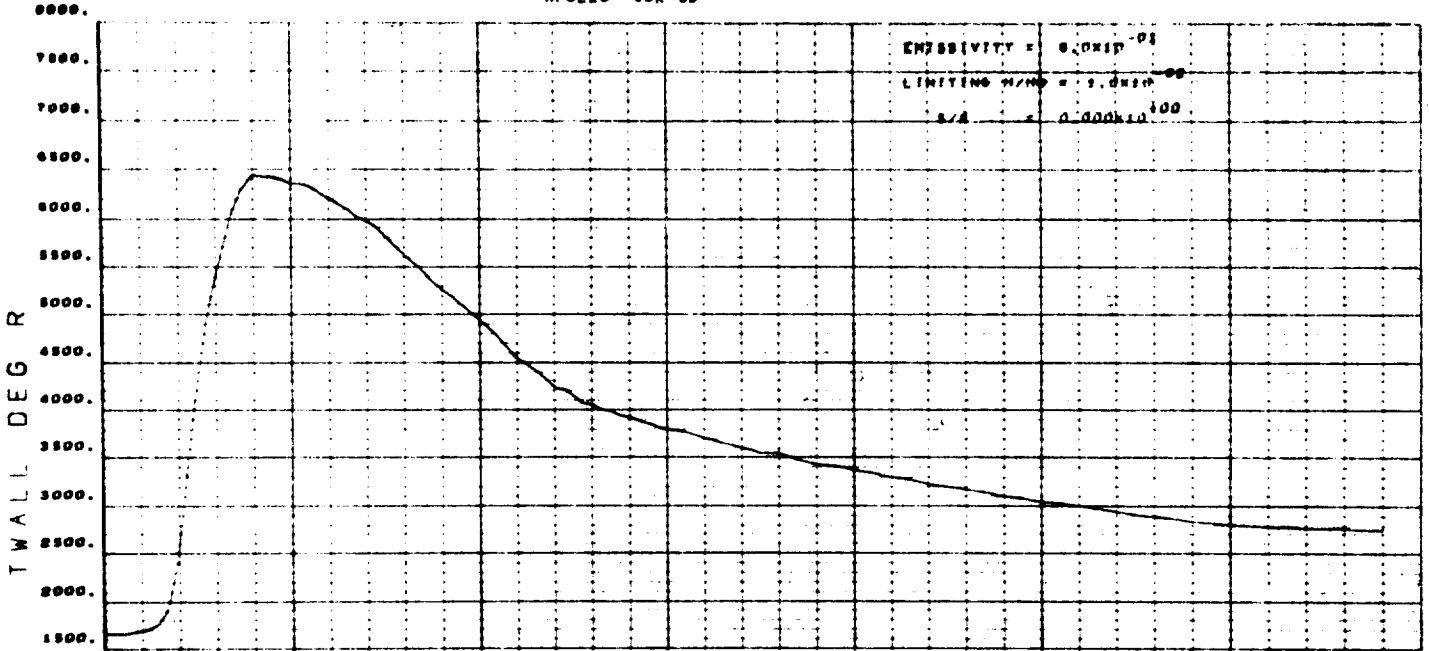


FIGURE A 67

ENERGY ACCOMMODATION MECHANISMS

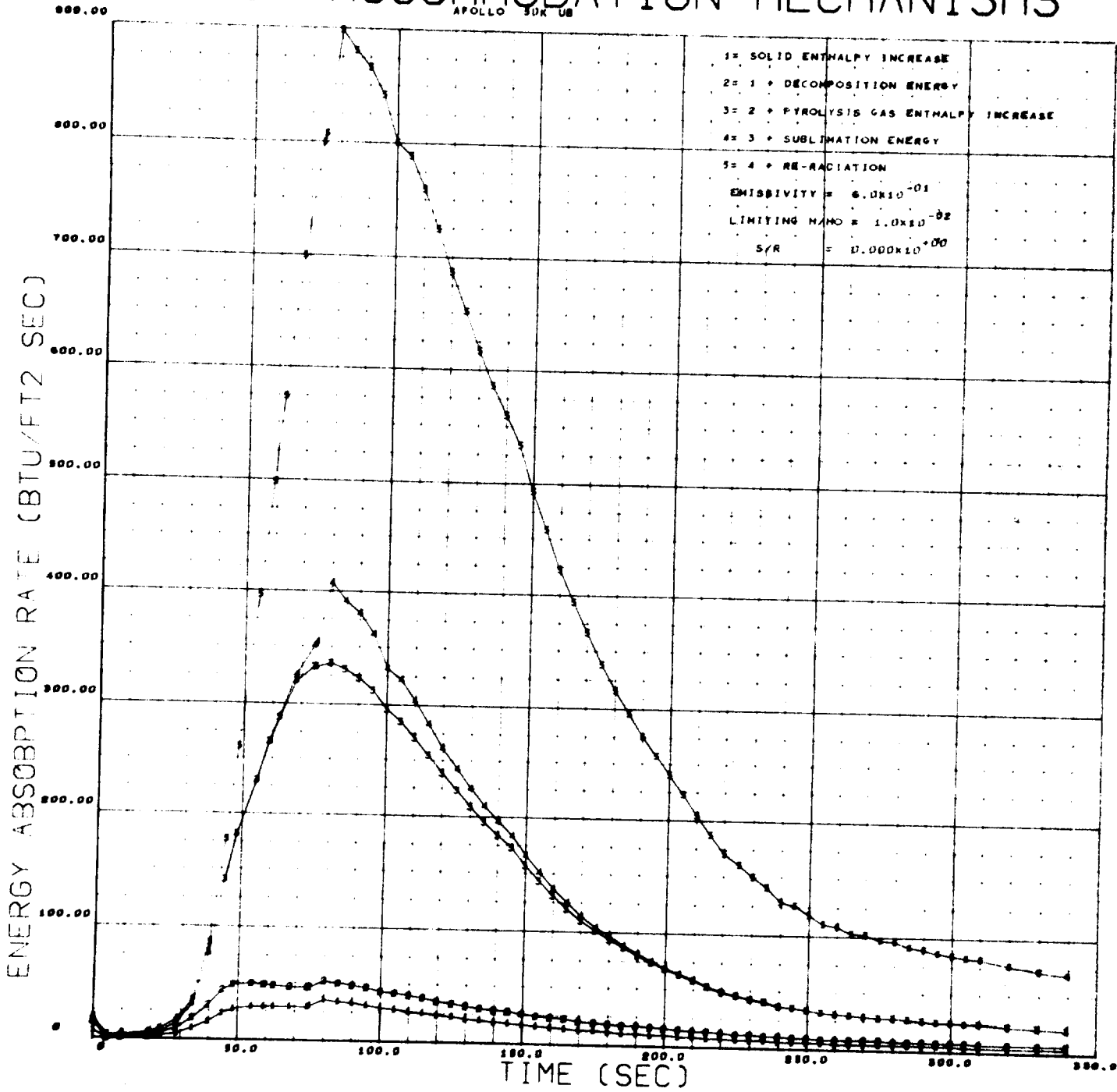


FIGURE A 68

HEATING RATE HISTORY

APOLLO 10K 68

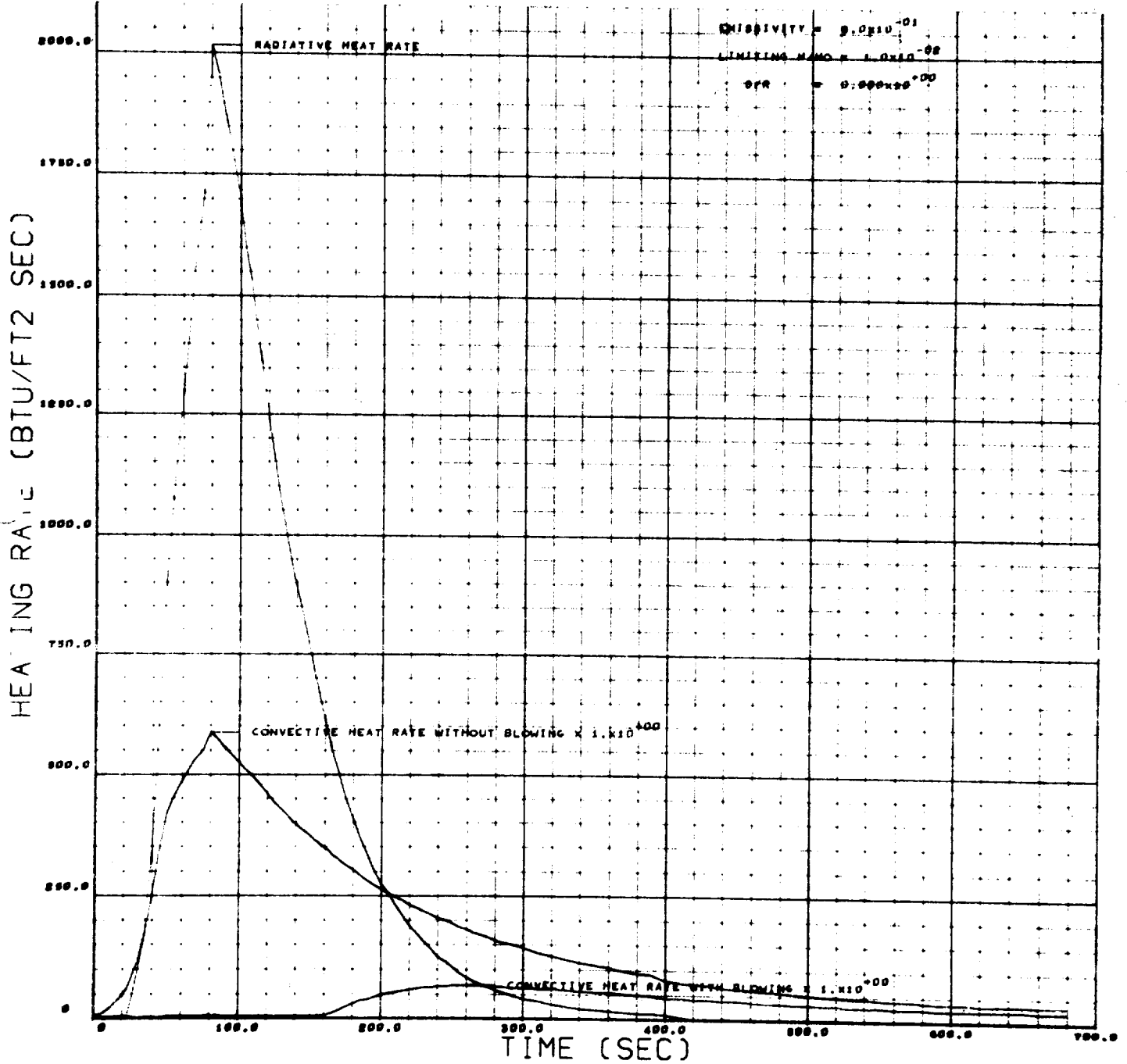


FIGURE A 68

MATERIAL RESPONSE DATA

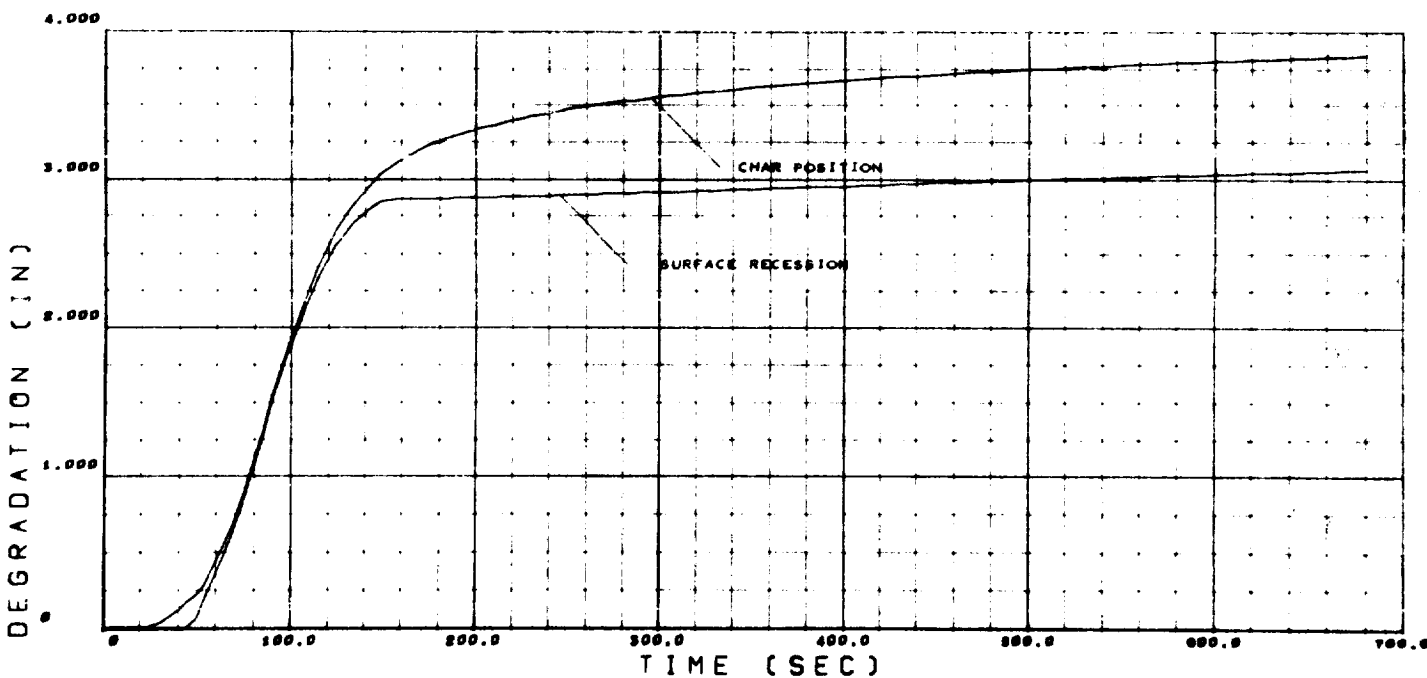
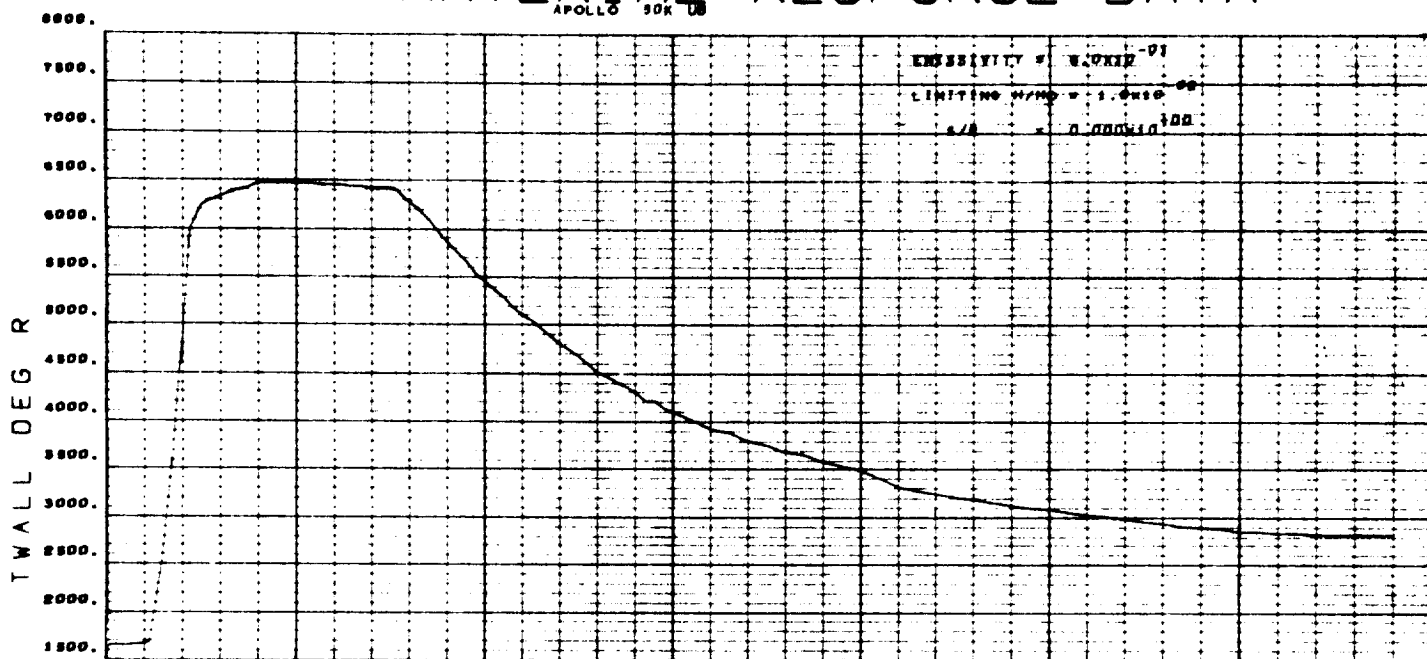


FIGURE A68

ENERGY ACCOMMODATION MECHANISMS

APOLLO 30X LB

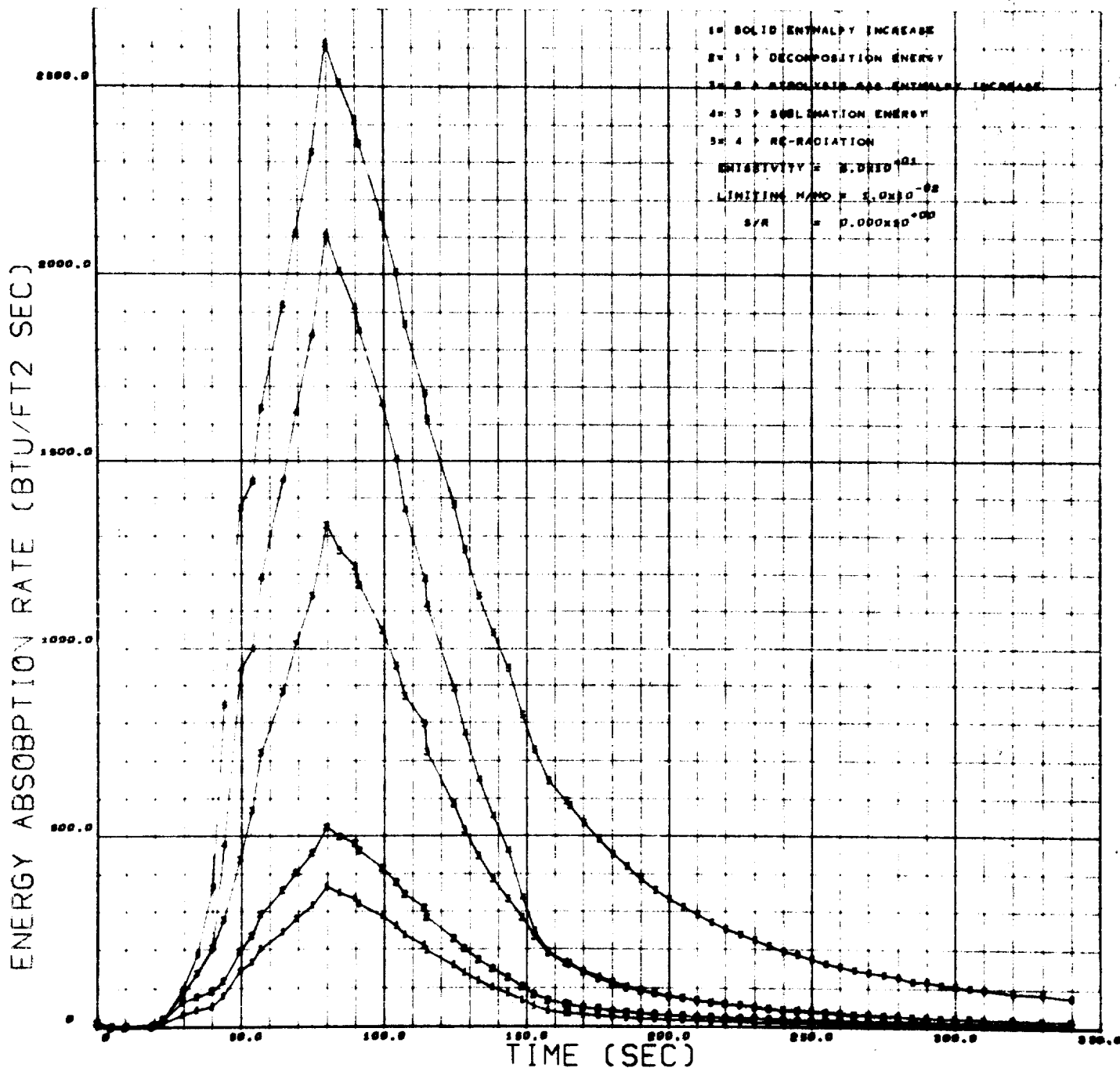


FIGURE A 69

HEATING RATE HISTORY

APOLLO 50K UB

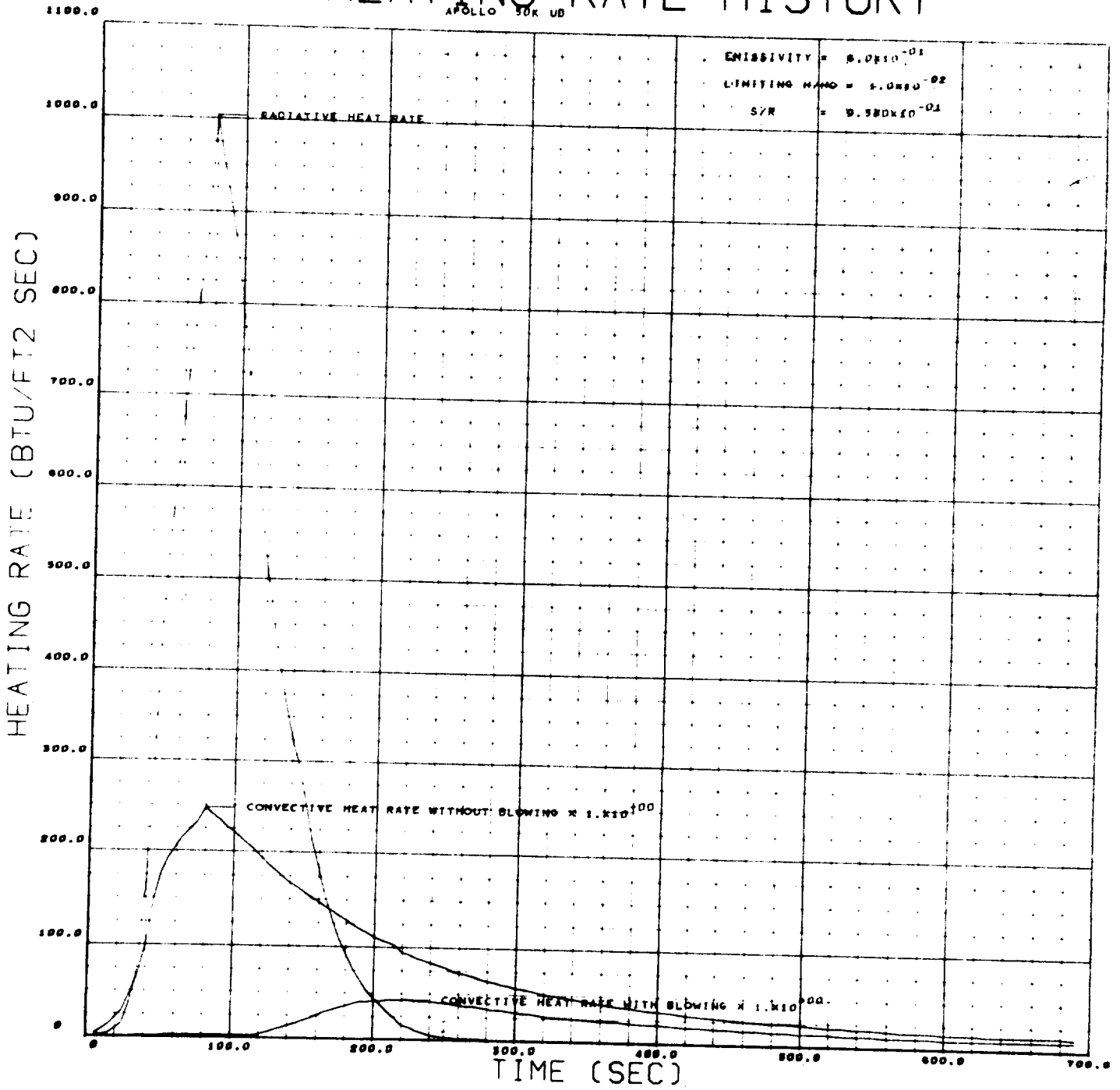


FIGURE A 69

MATERIAL RESPONSE DATA

APOLLO SUB UB

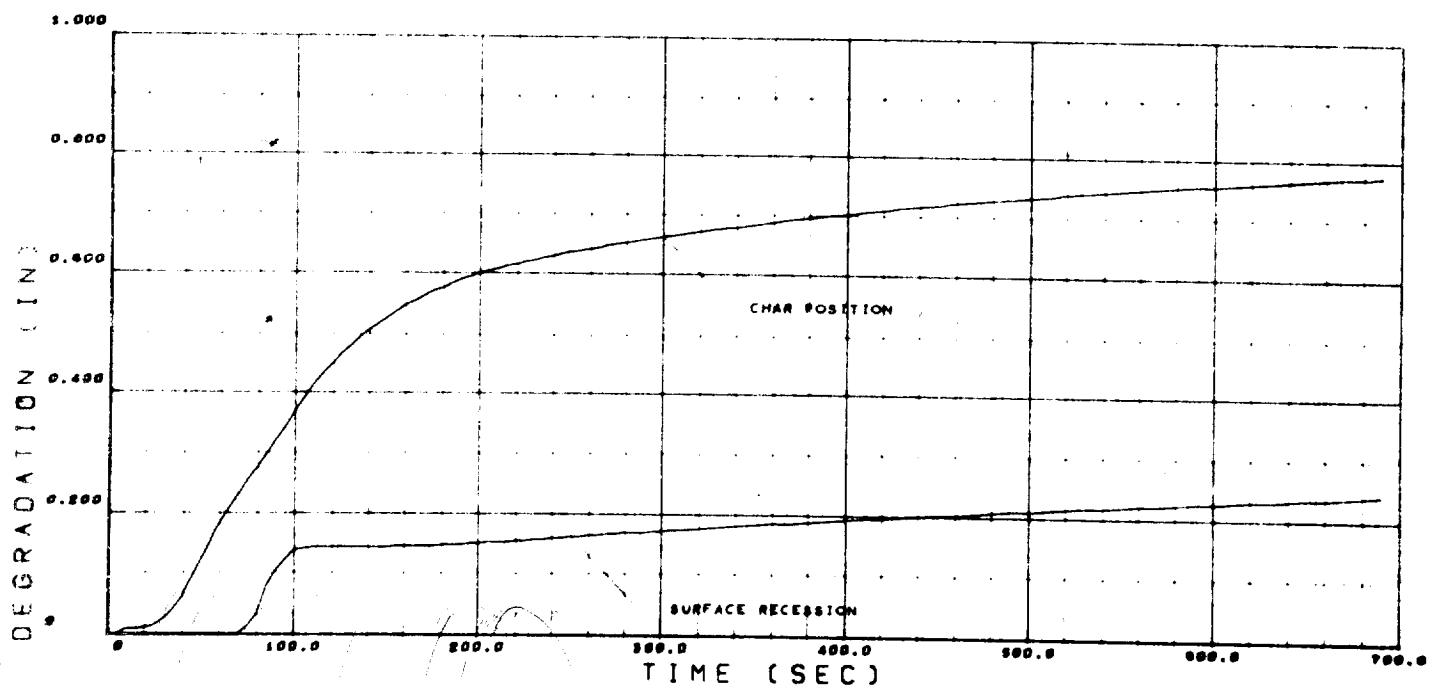
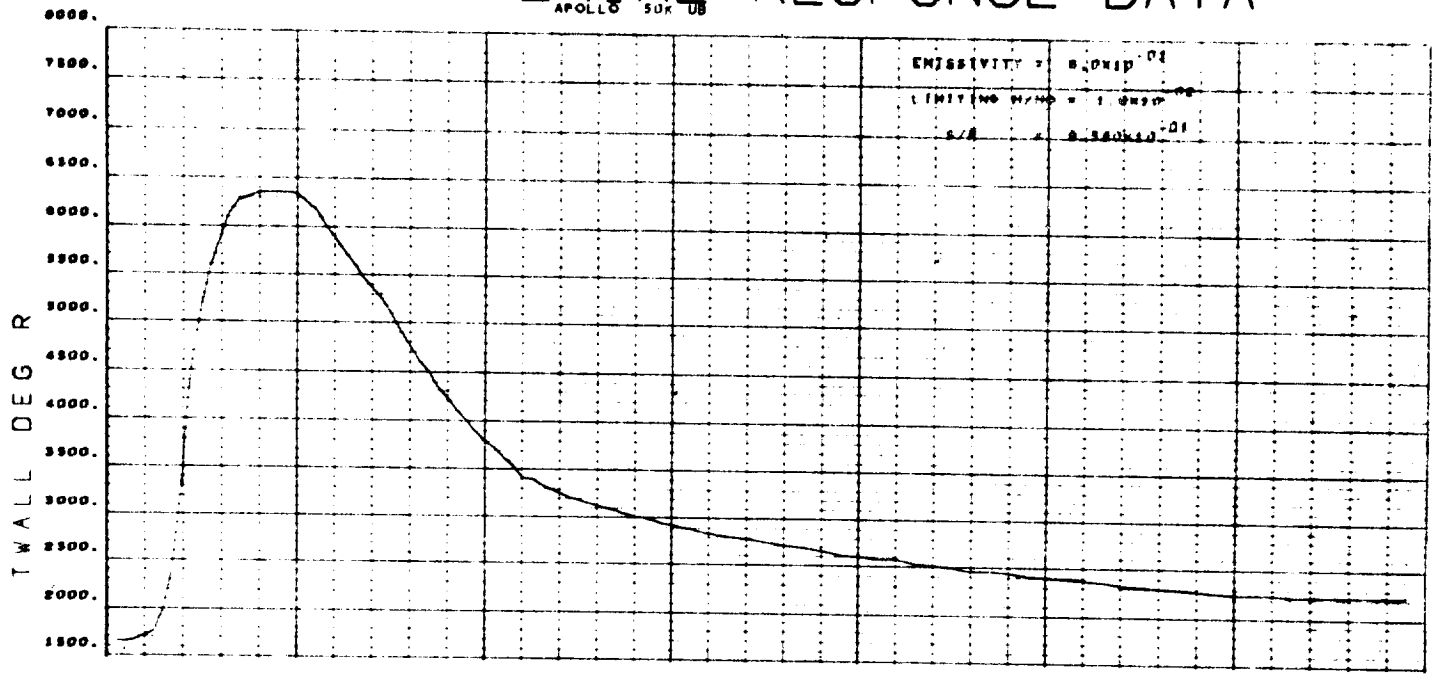


FIGURE A 69

ENERGY ACCOMMODATION MECHANISMS

APOLLO 50K UB

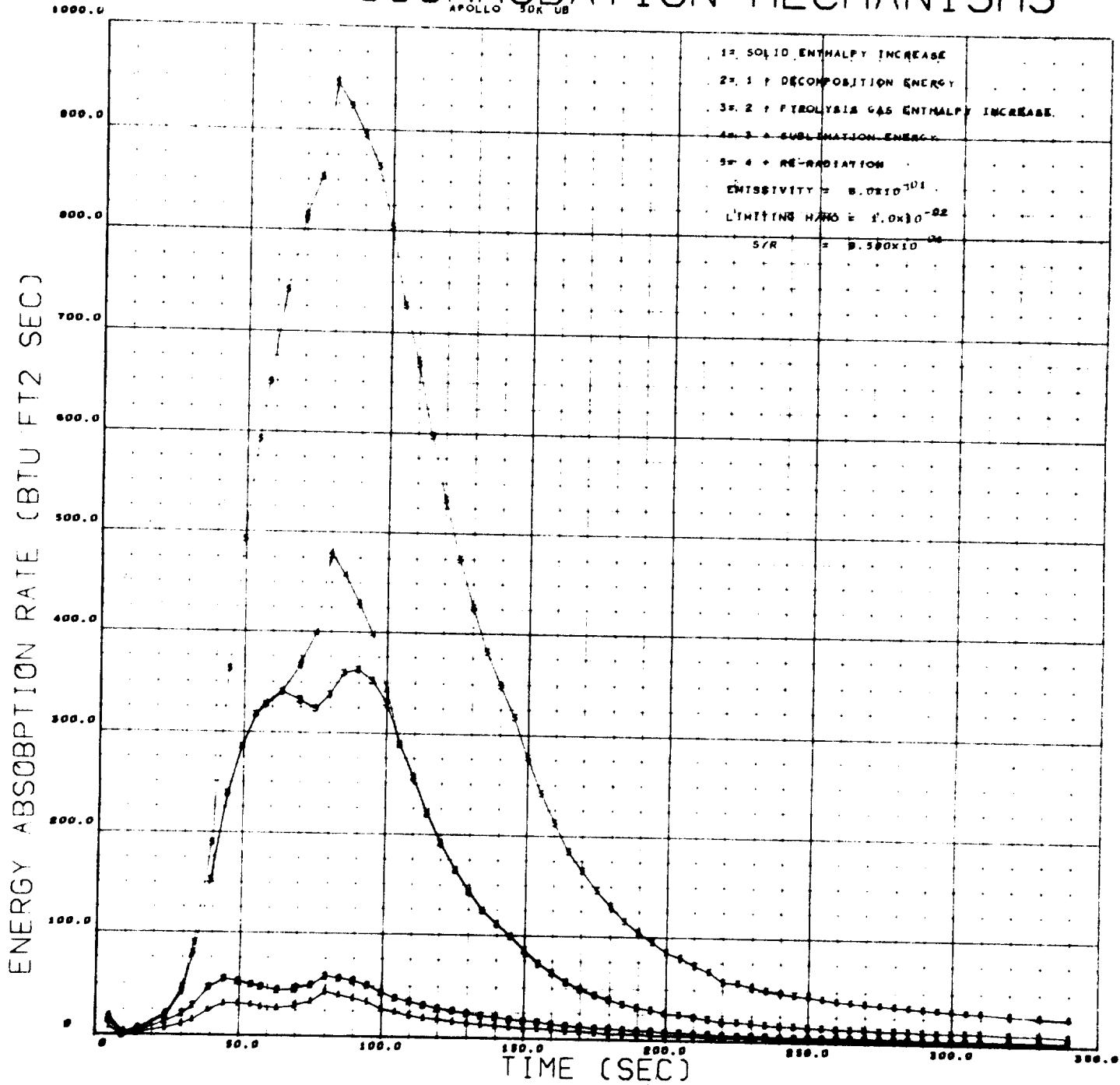


FIGURE A 70

HEATING RATE HISTORY

APOLLO 30K UB

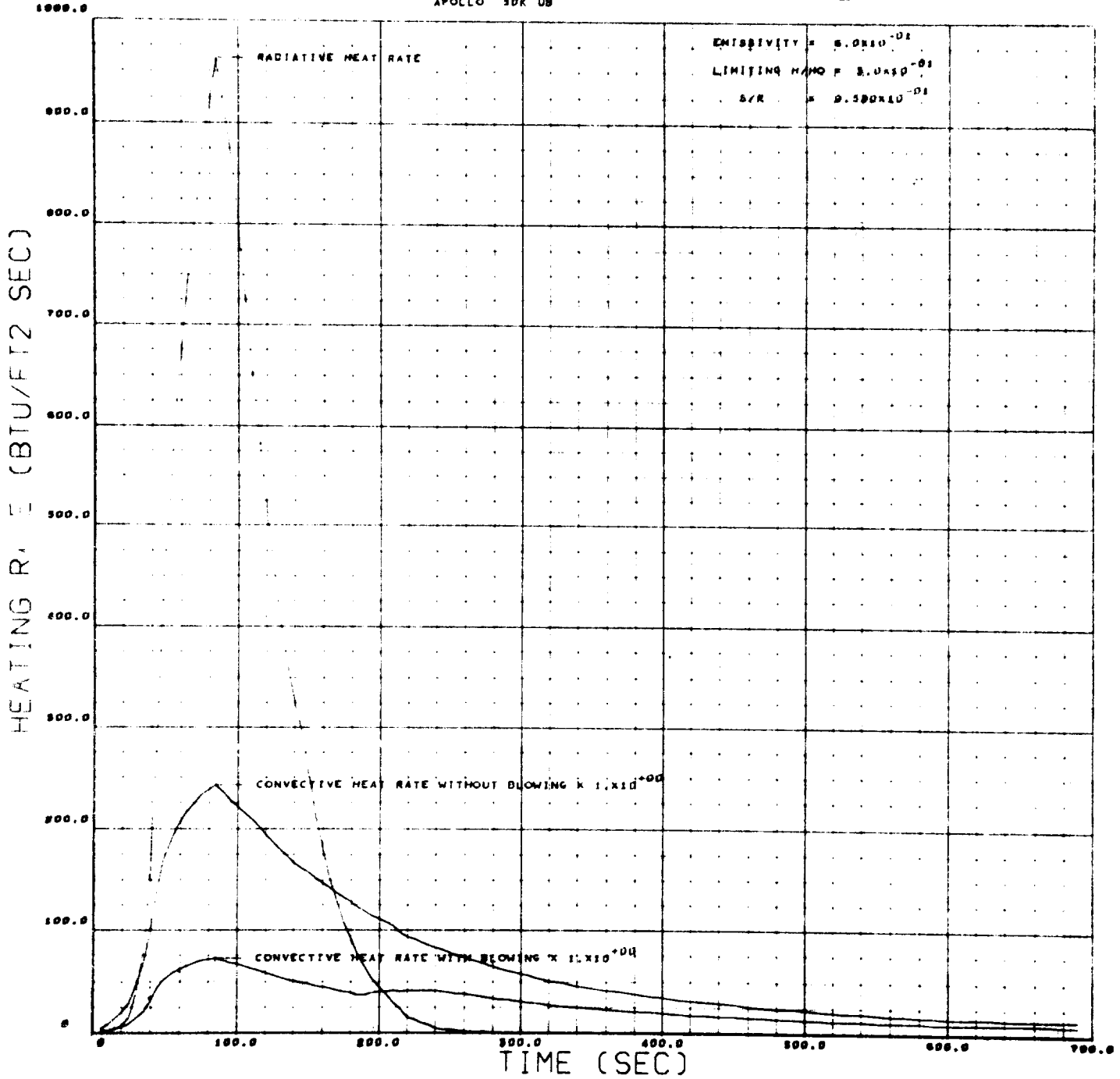


FIGURE A 70

MATERIAL RESPONSE DATA

APOLLO 50K UB

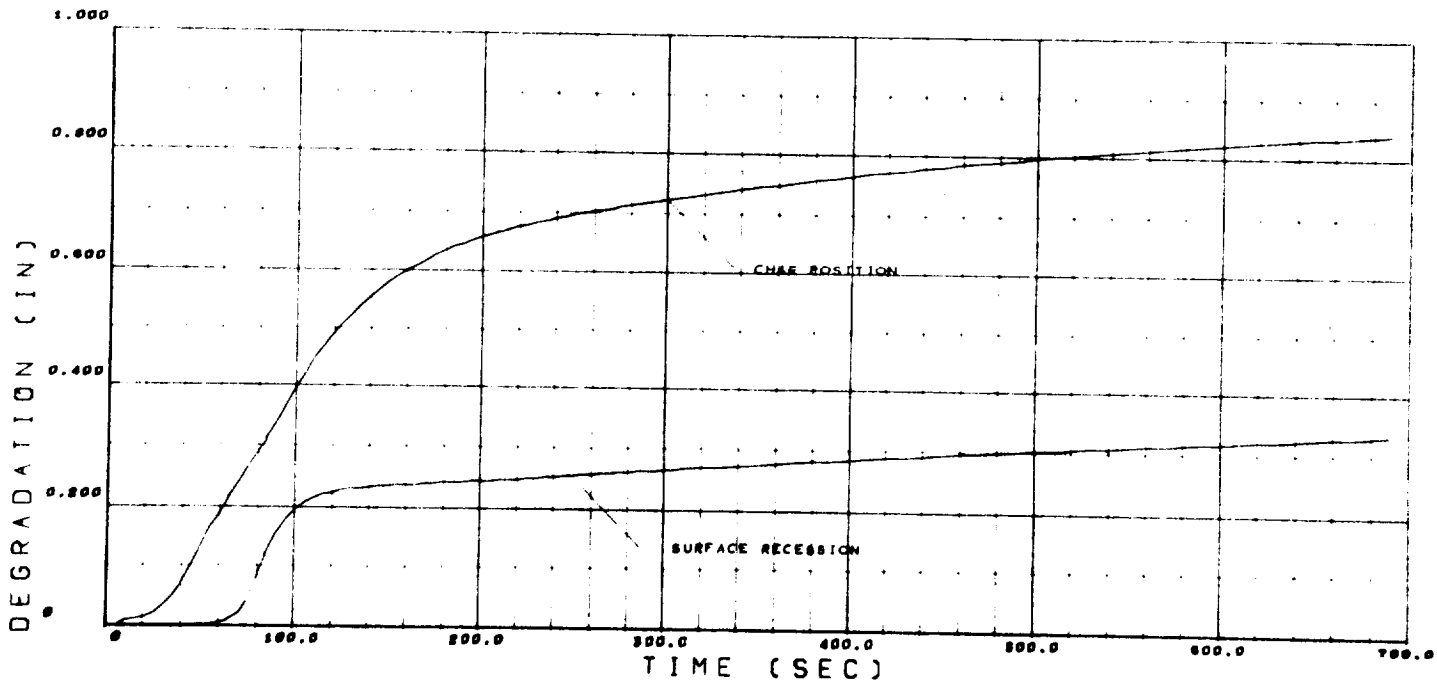
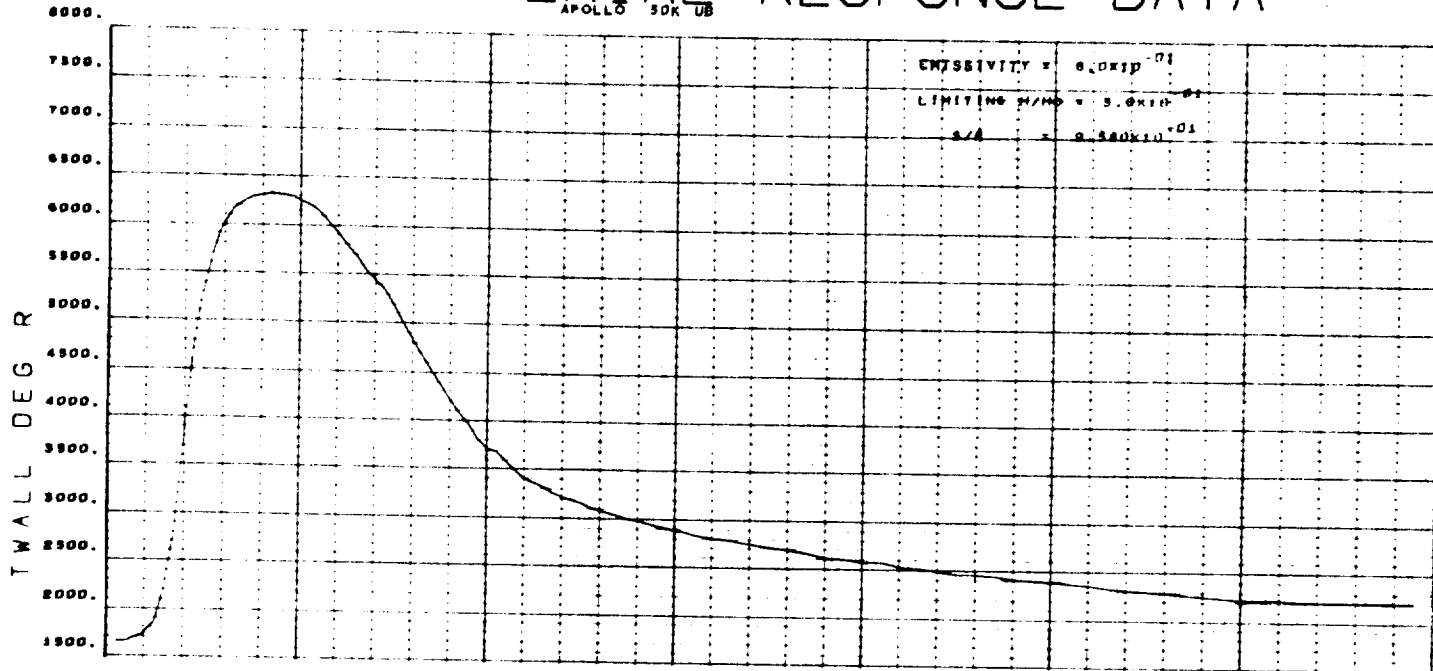


FIGURE A70

ENERGY ACCOMMODATION MECHANISMS

APOLLO 30R UB

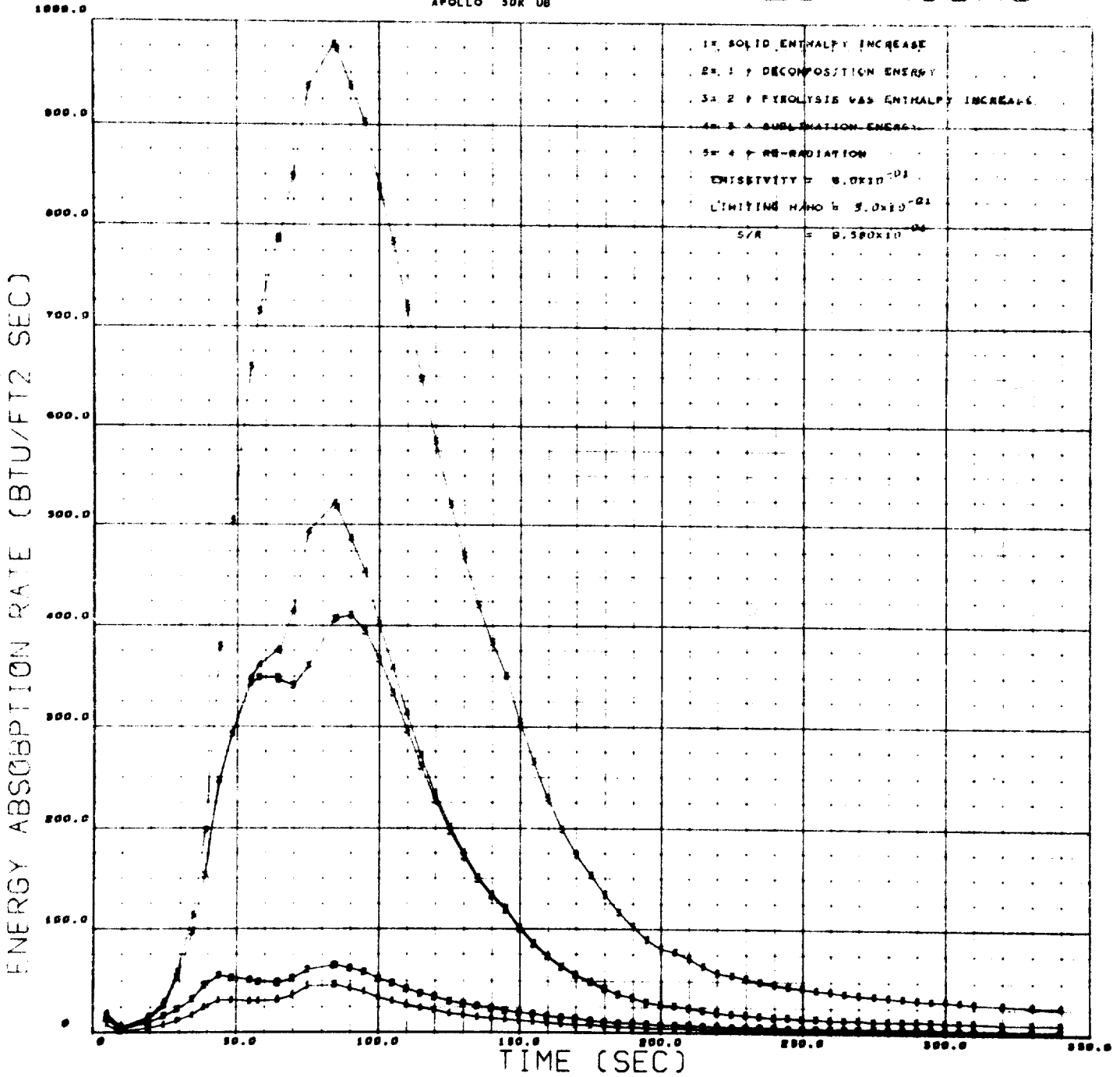


FIGURE A 71

HEATING RATE HISTORY

APOLLO 30K LB

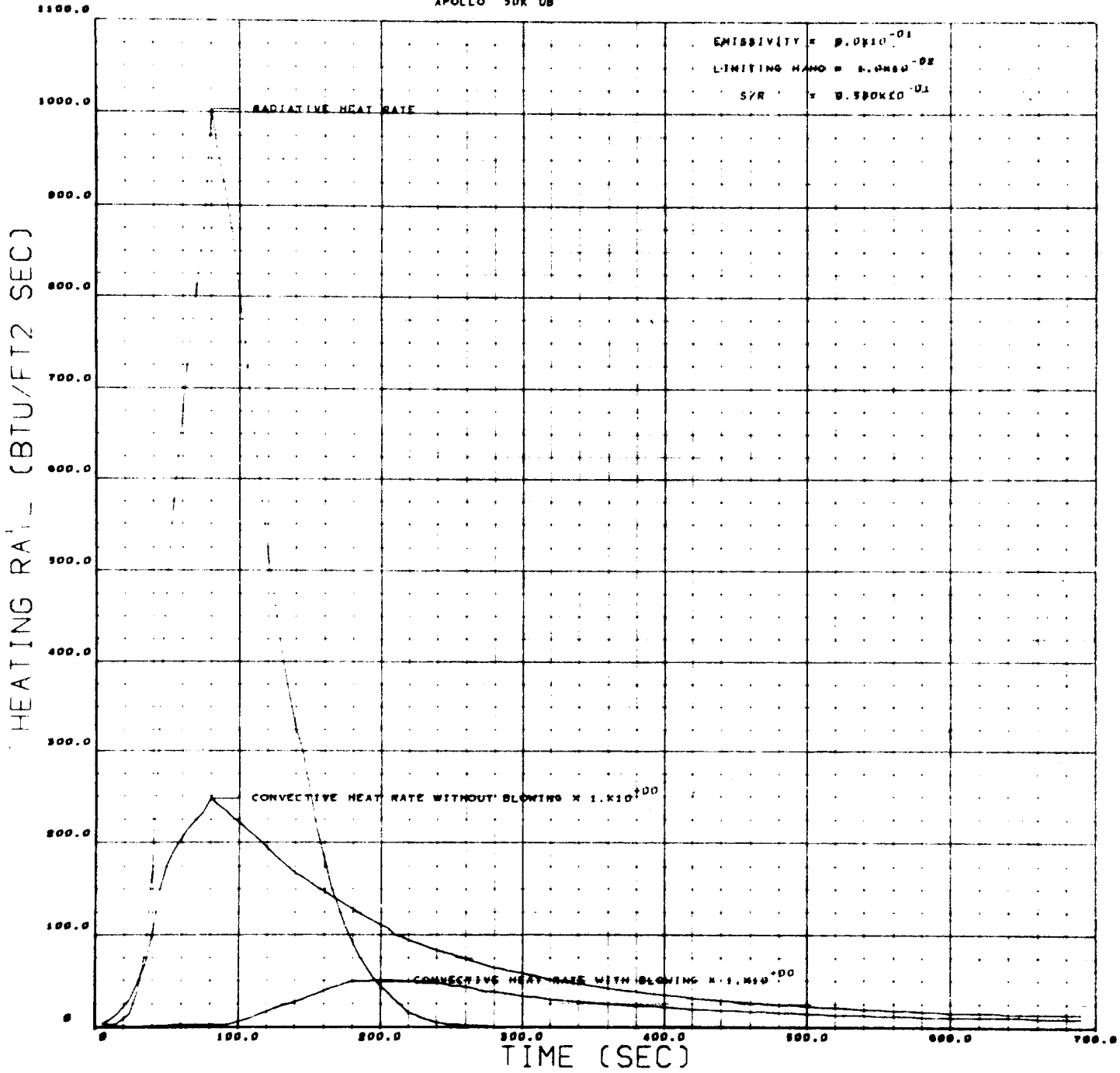


FIGURE A 71

MATERIAL RESPONSE DATA

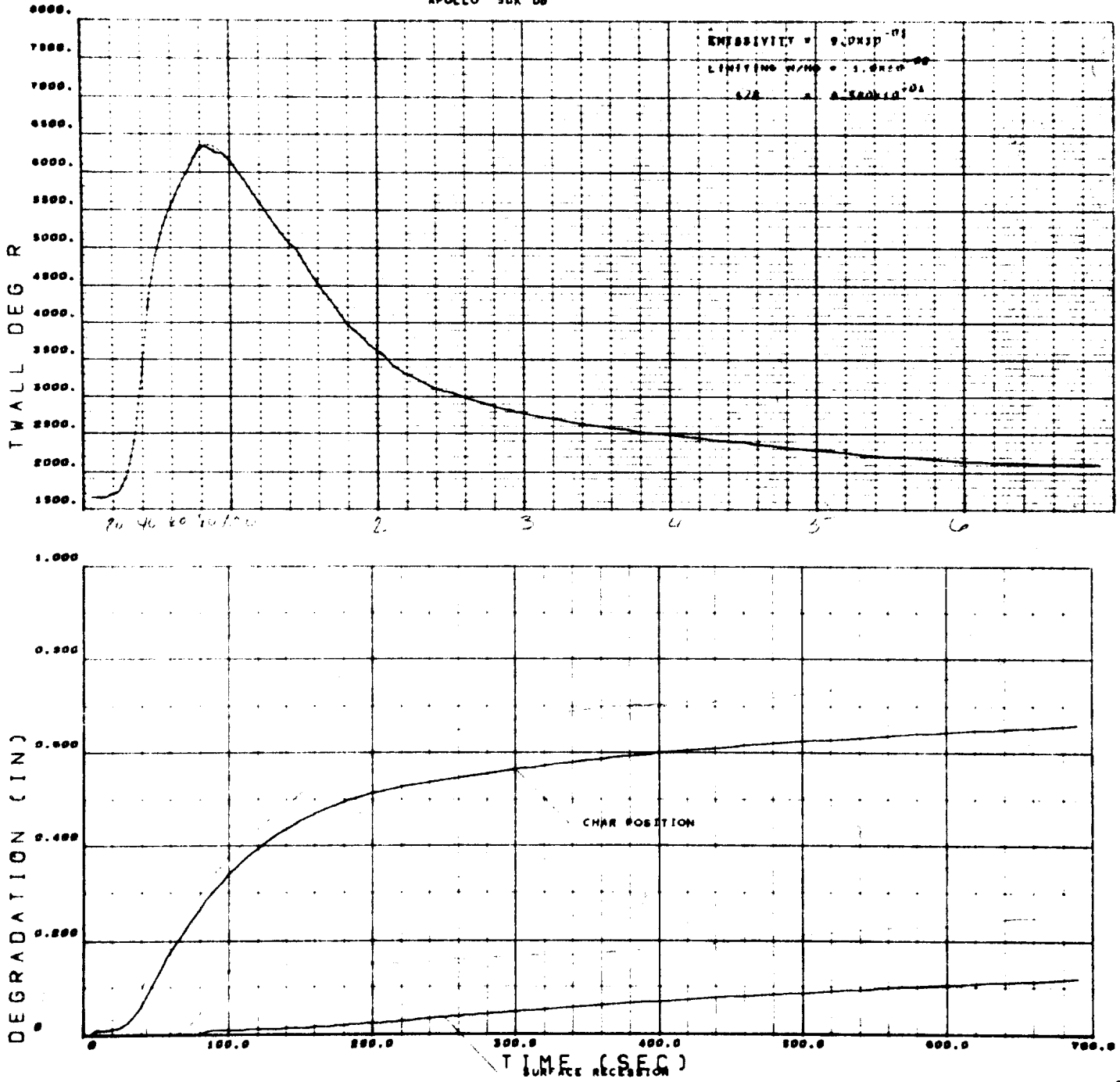


FIGURE A 71

ENERGY ACCOMMODATION MECHANISMS

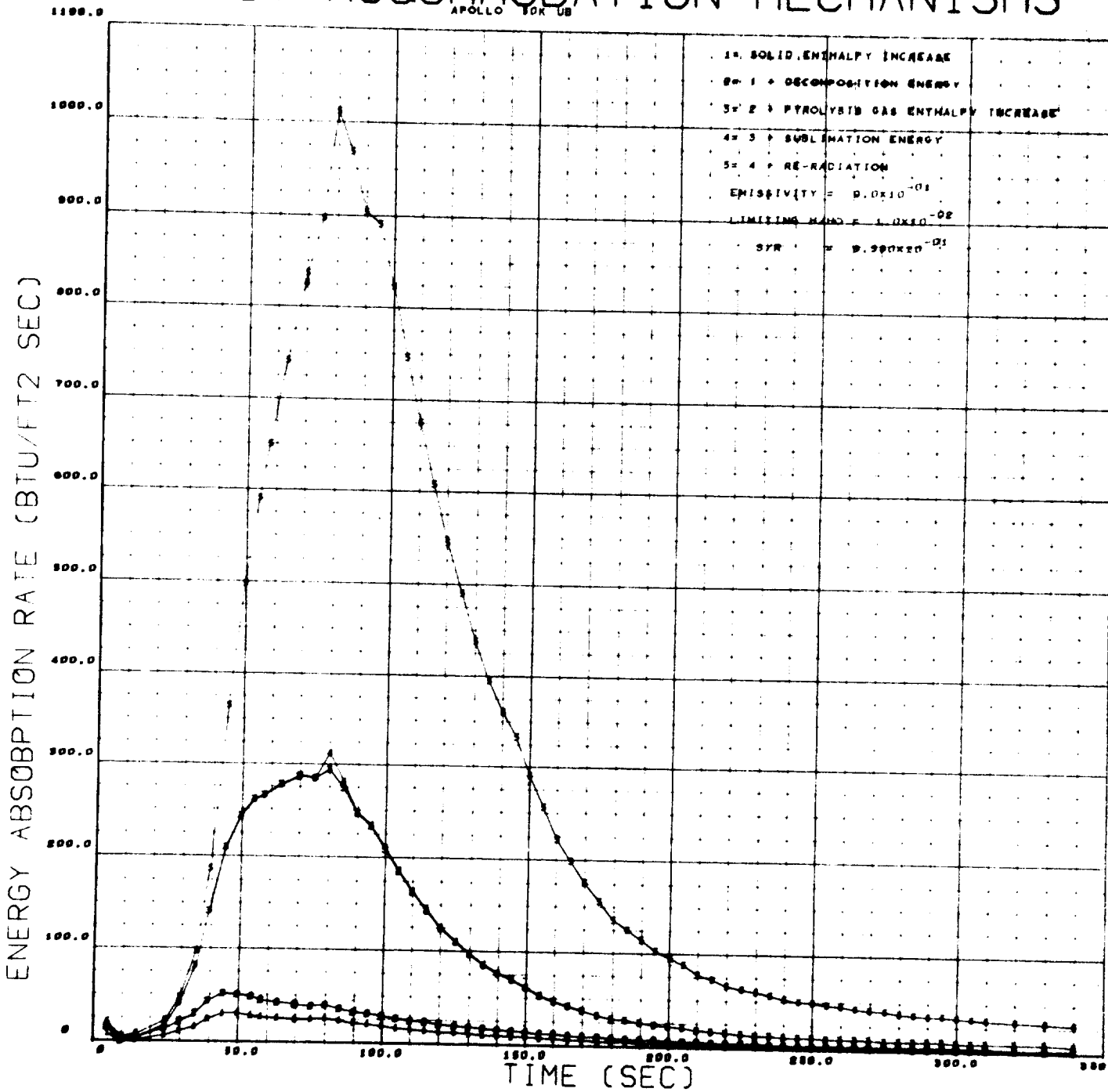


FIGURE A 72

HEATING RATE HISTORY

APOLLO 13R US

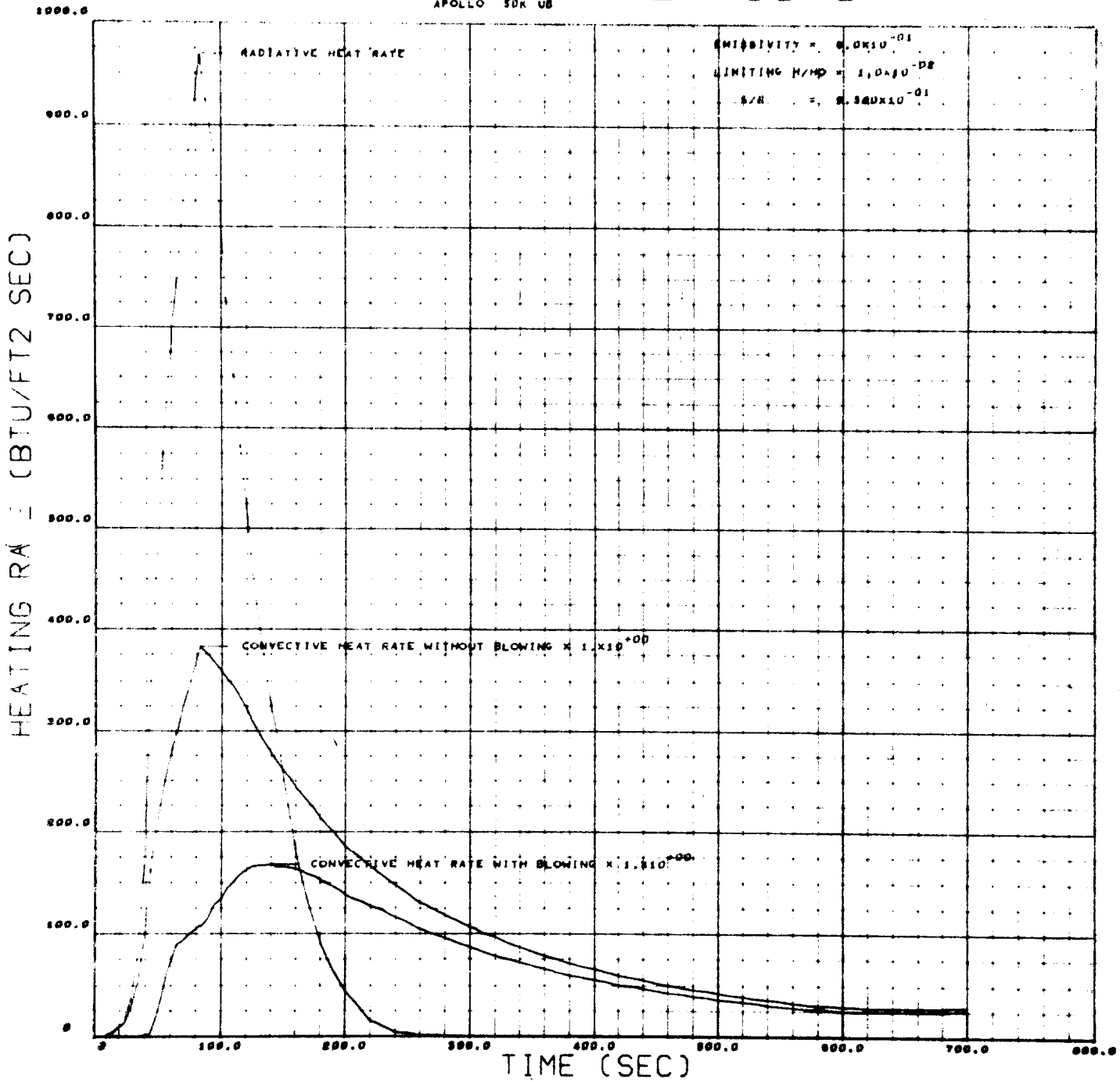


FIGURE A 72

MATERIAL RESPONSE DATA

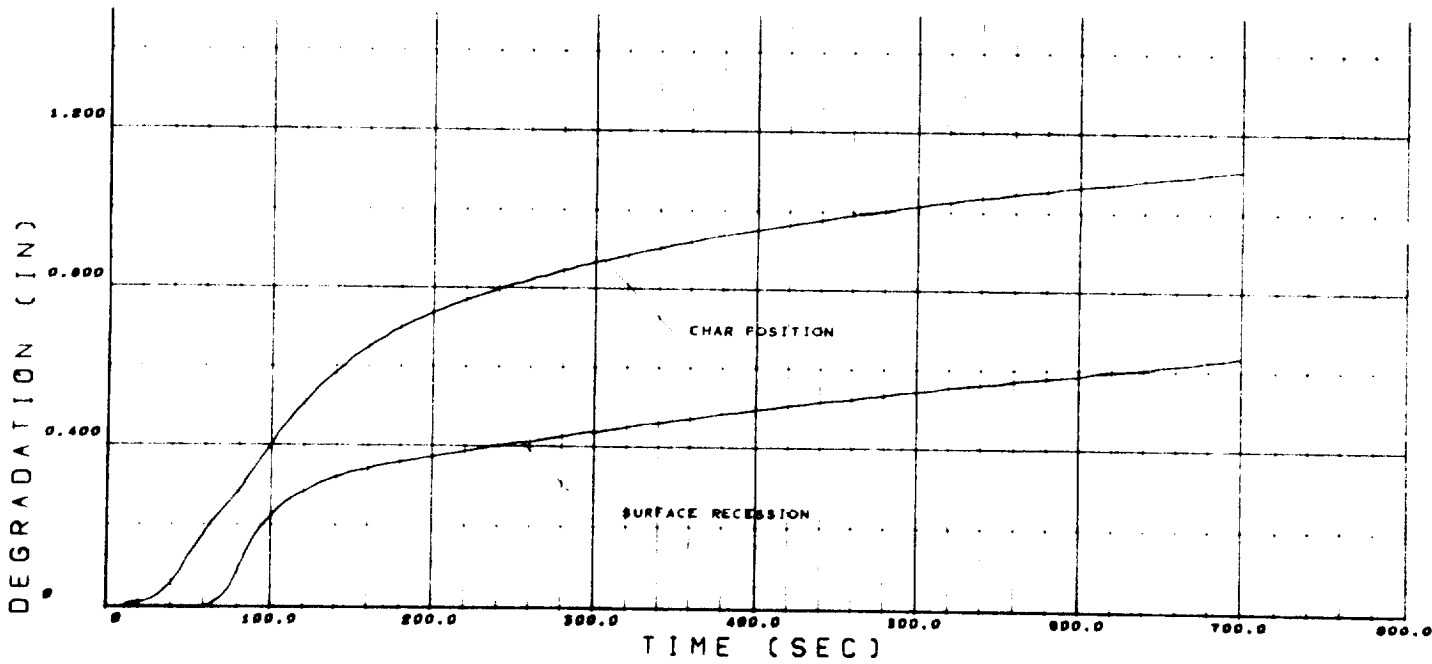
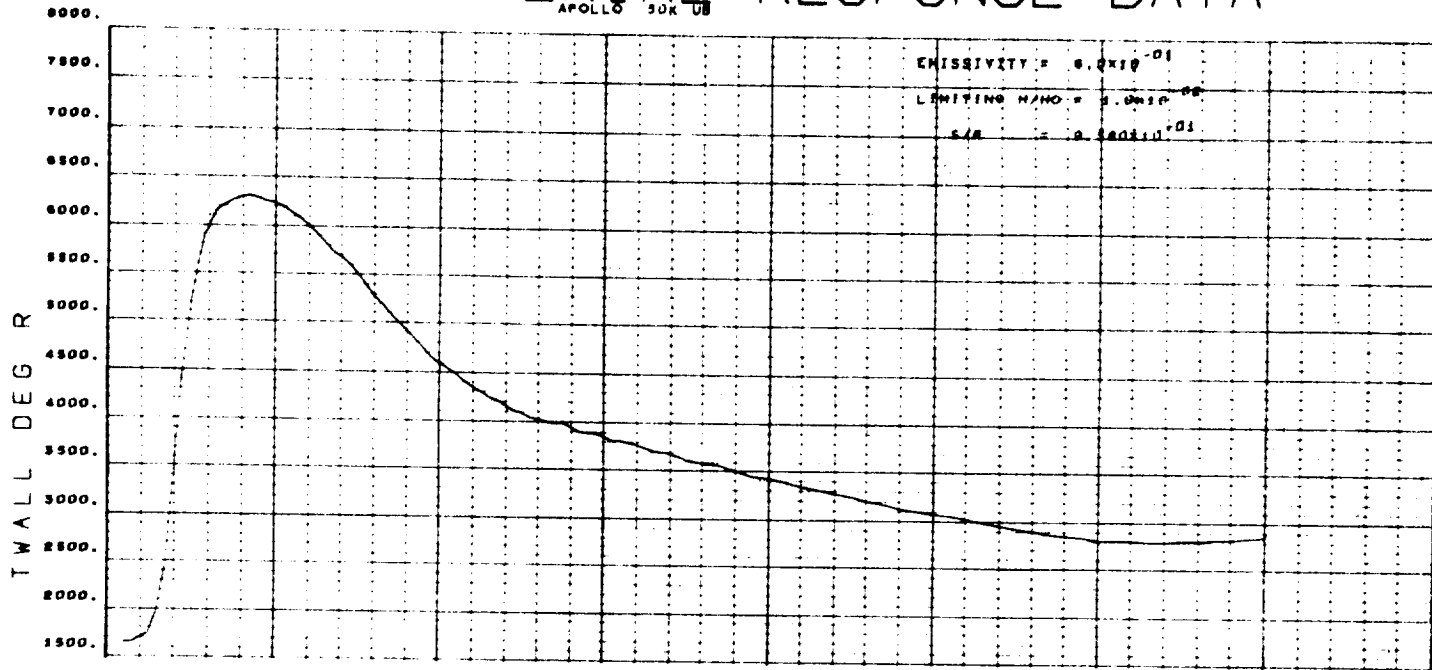


FIGURE A72

ENERGY ACCOMMODATION MECHANISMS

APOLLO 30K 08

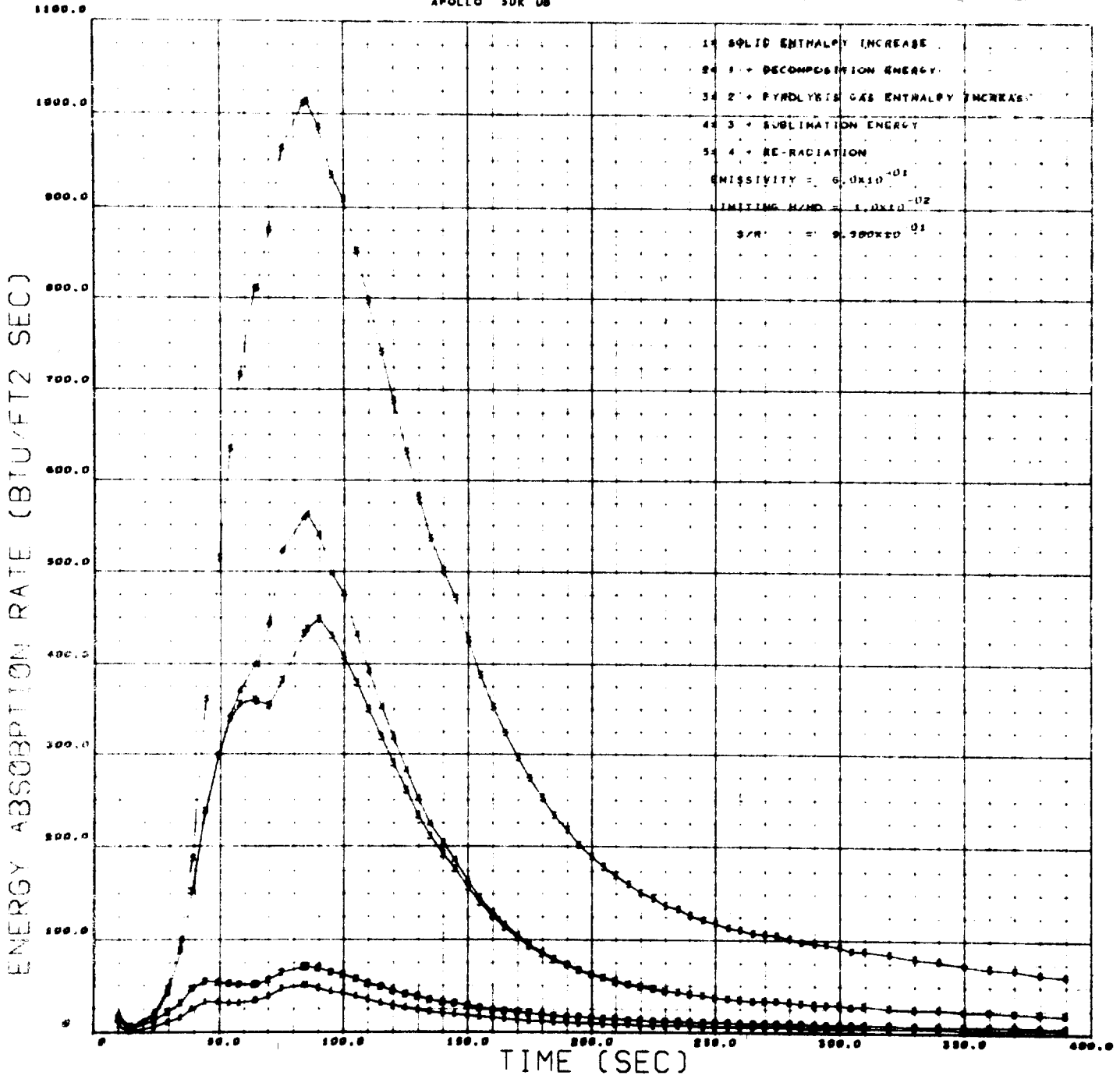


FIGURE A 23

HEATING RATE HISTORY

APOLLO 10K US

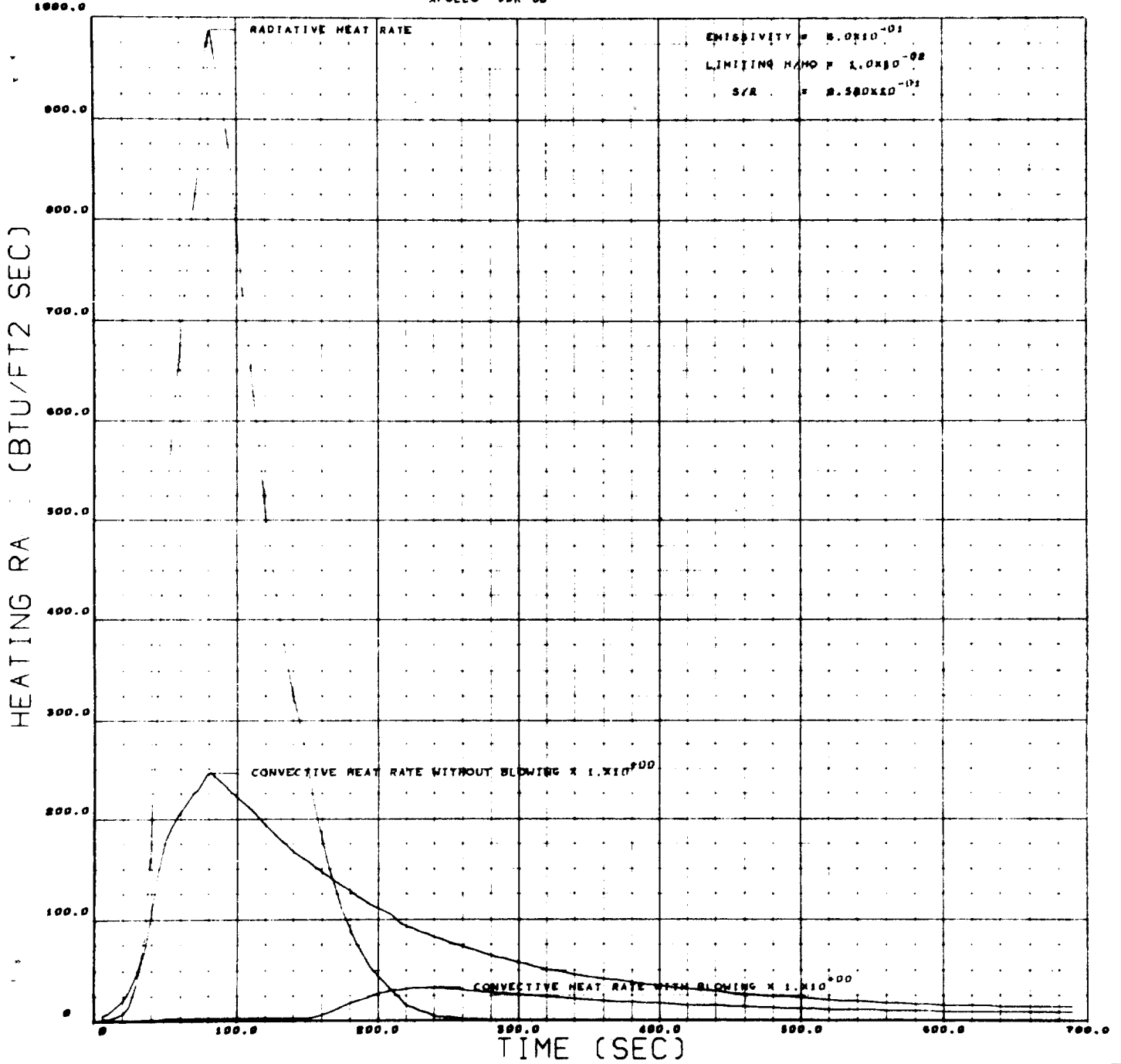


FIGURE A 73

MATERIAL RESPONSE DATA

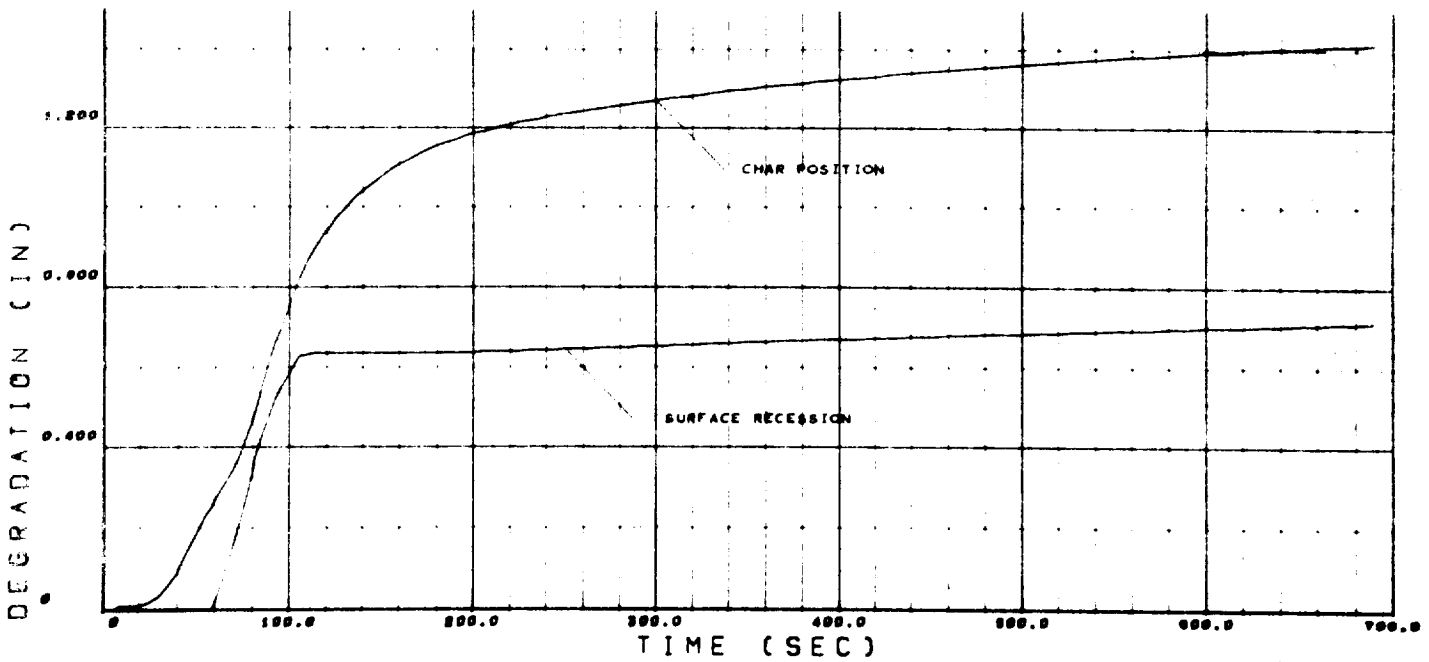
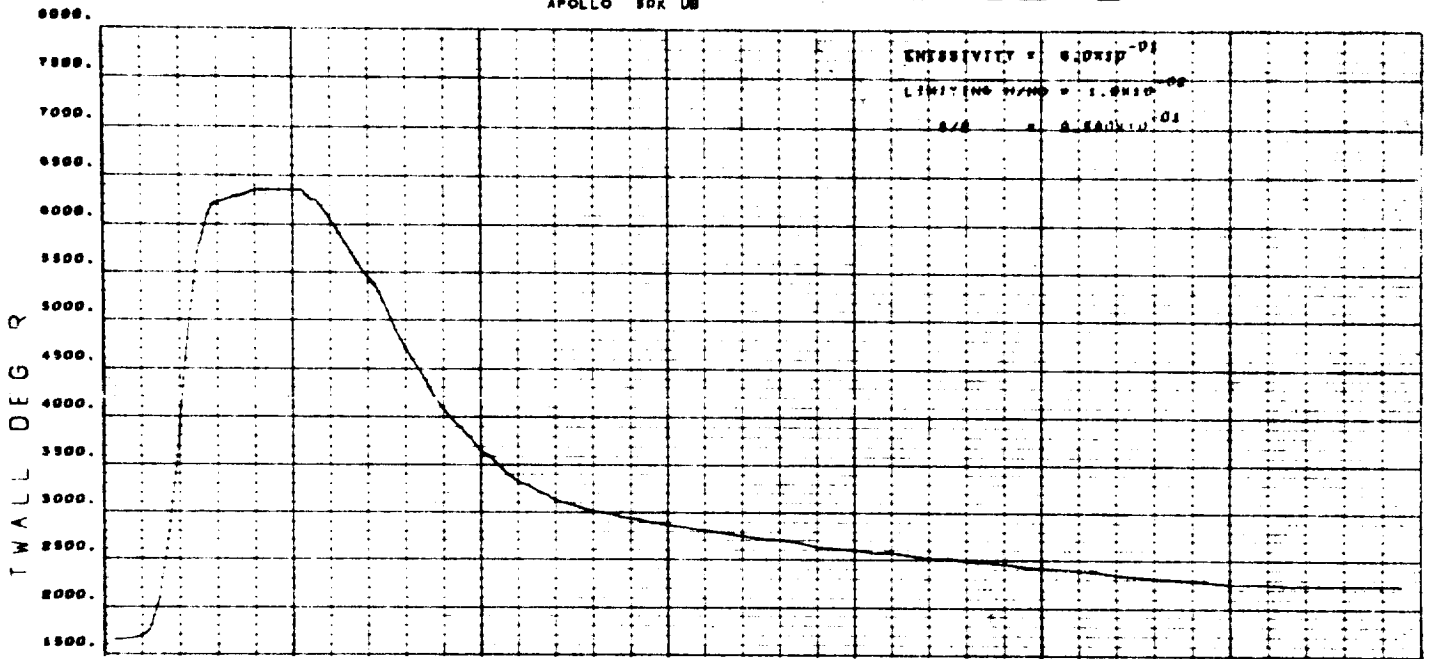


FIGURE A 75

ENERGY ACCOMMODATION MECHANISMS

APOLLO 16K 08

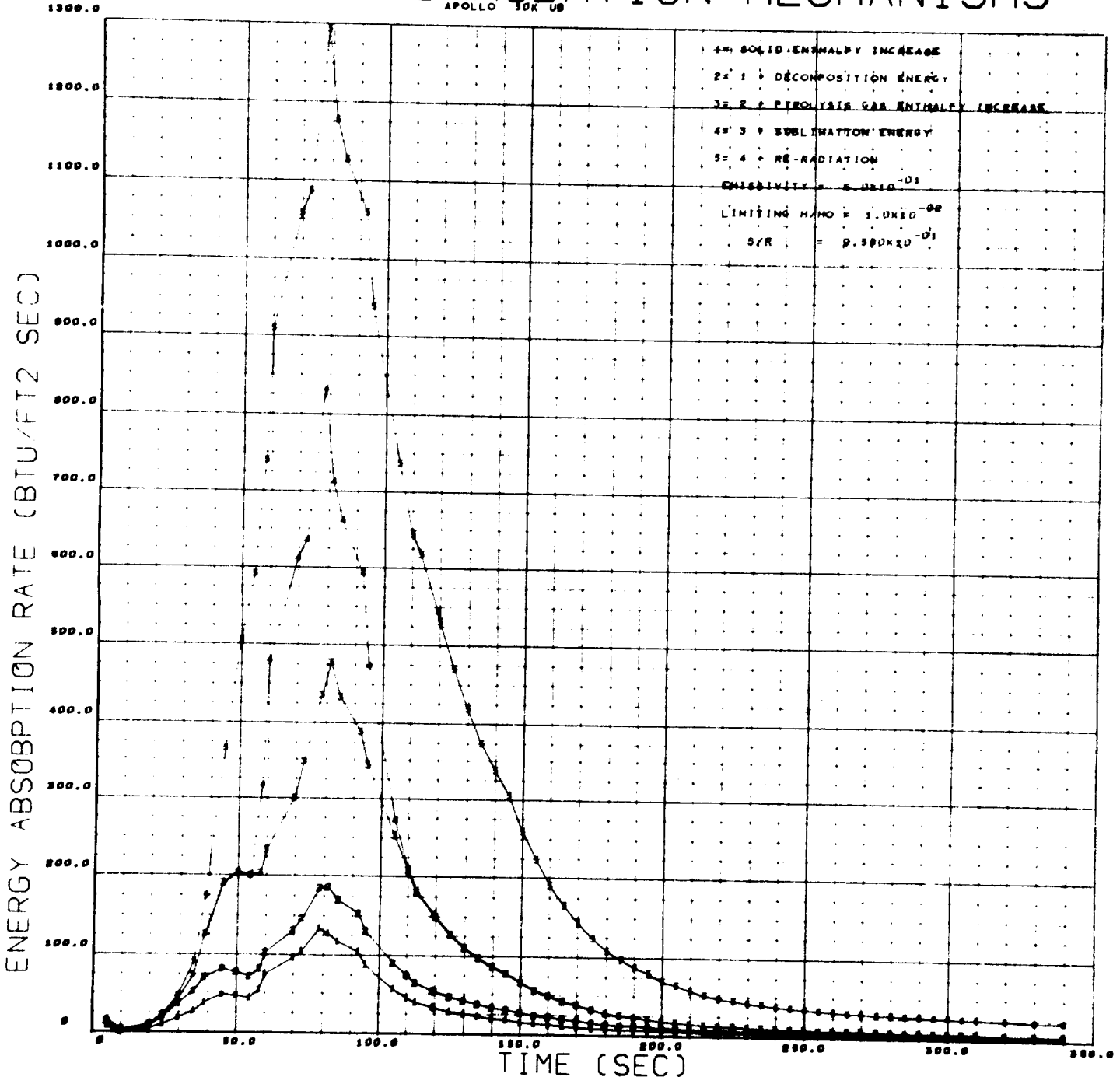


FIGURE A 74

HEATING RATE HISTORY

APOLLO 50K LB

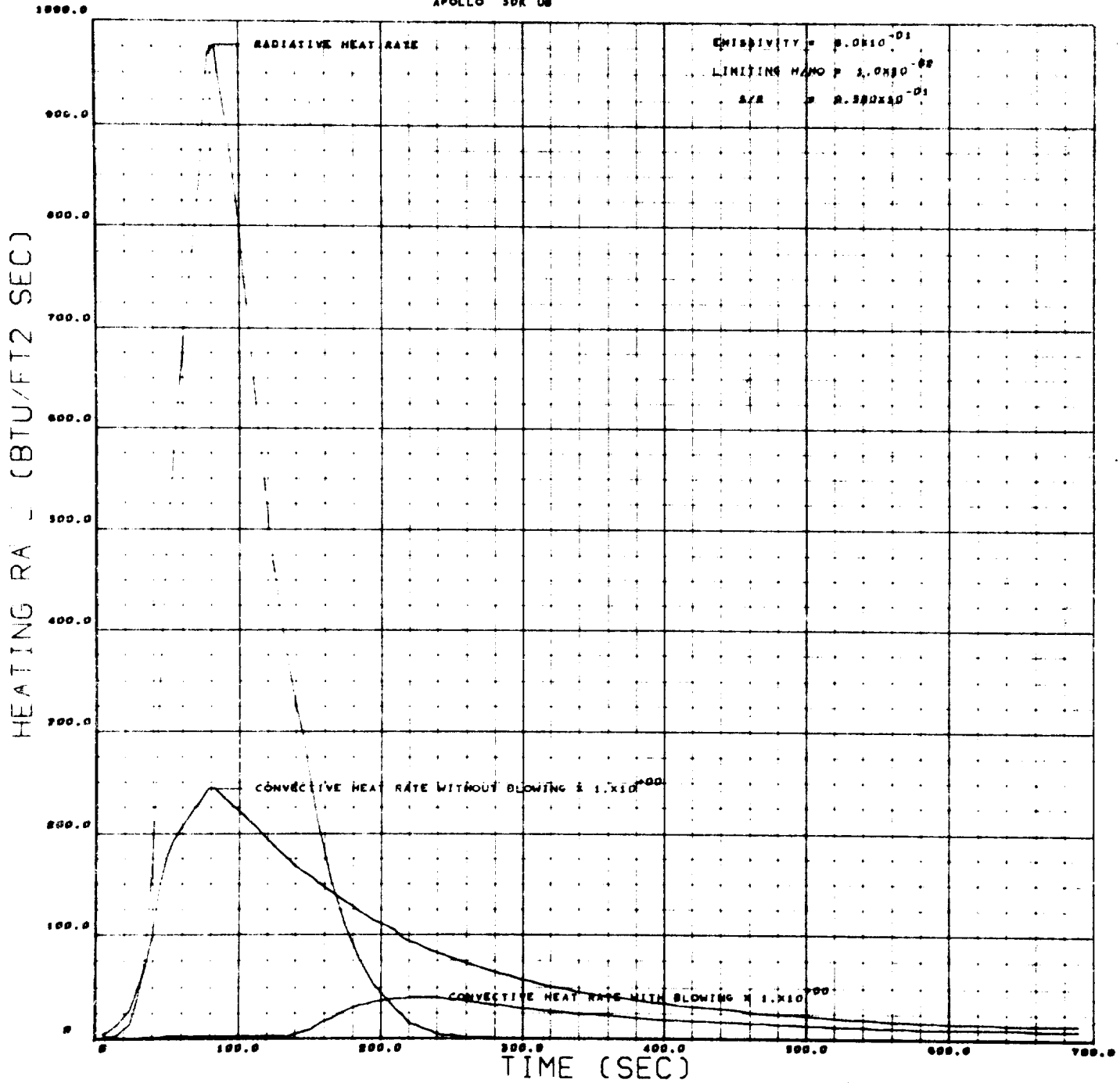


FIGURE A 74

MATERIAL RESPONSE DATA

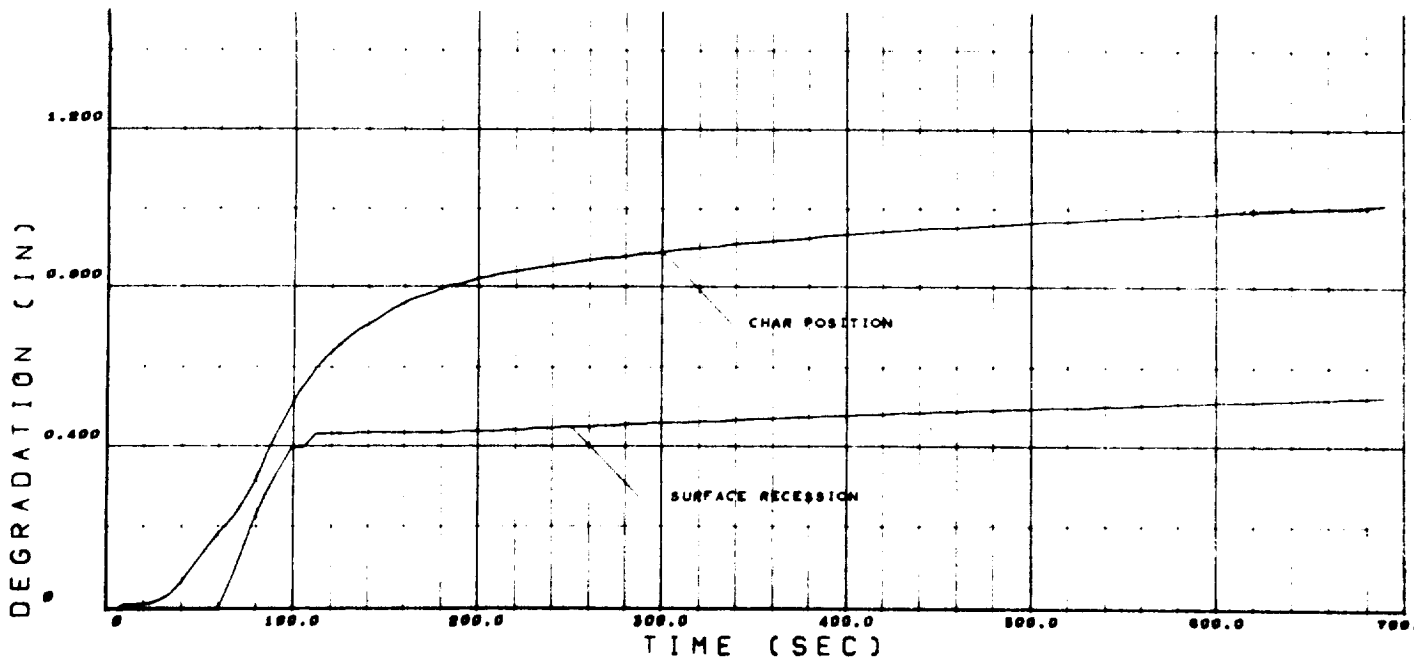
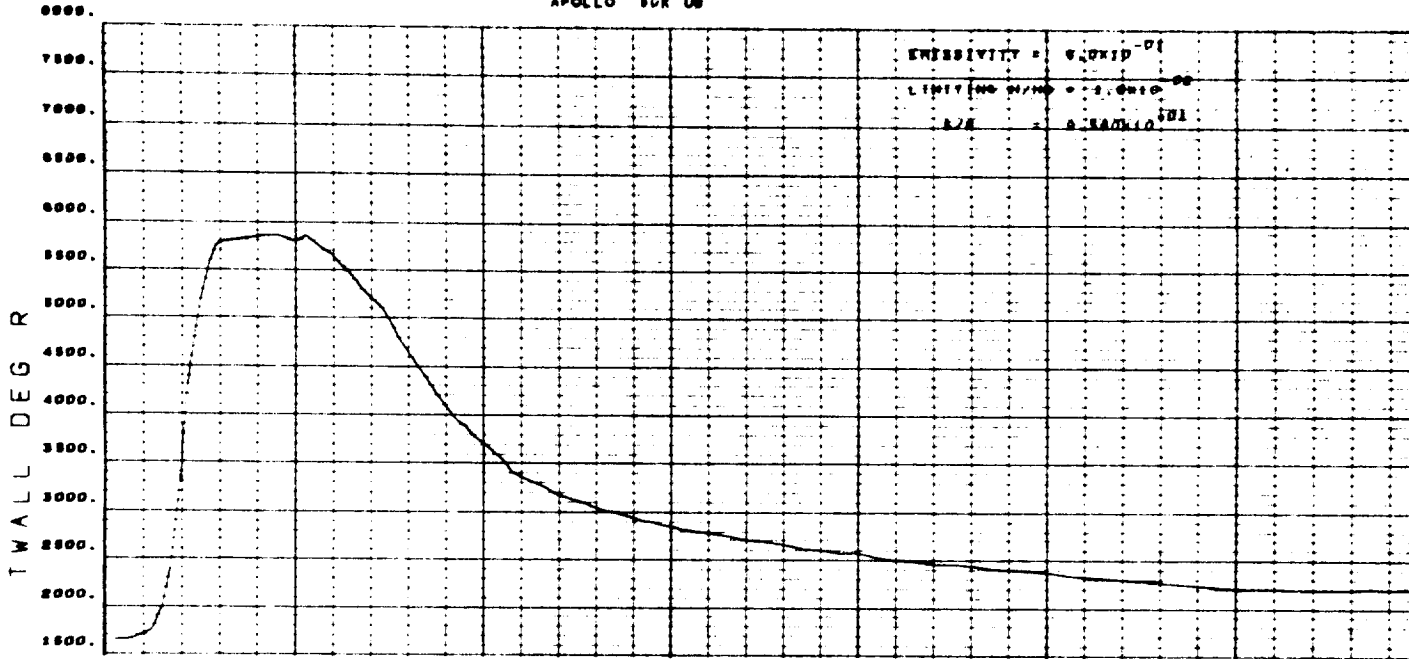


FIGURE A 74

ENERGY ACCOMMODATION MECHANISMS

APOLLO 30X LB

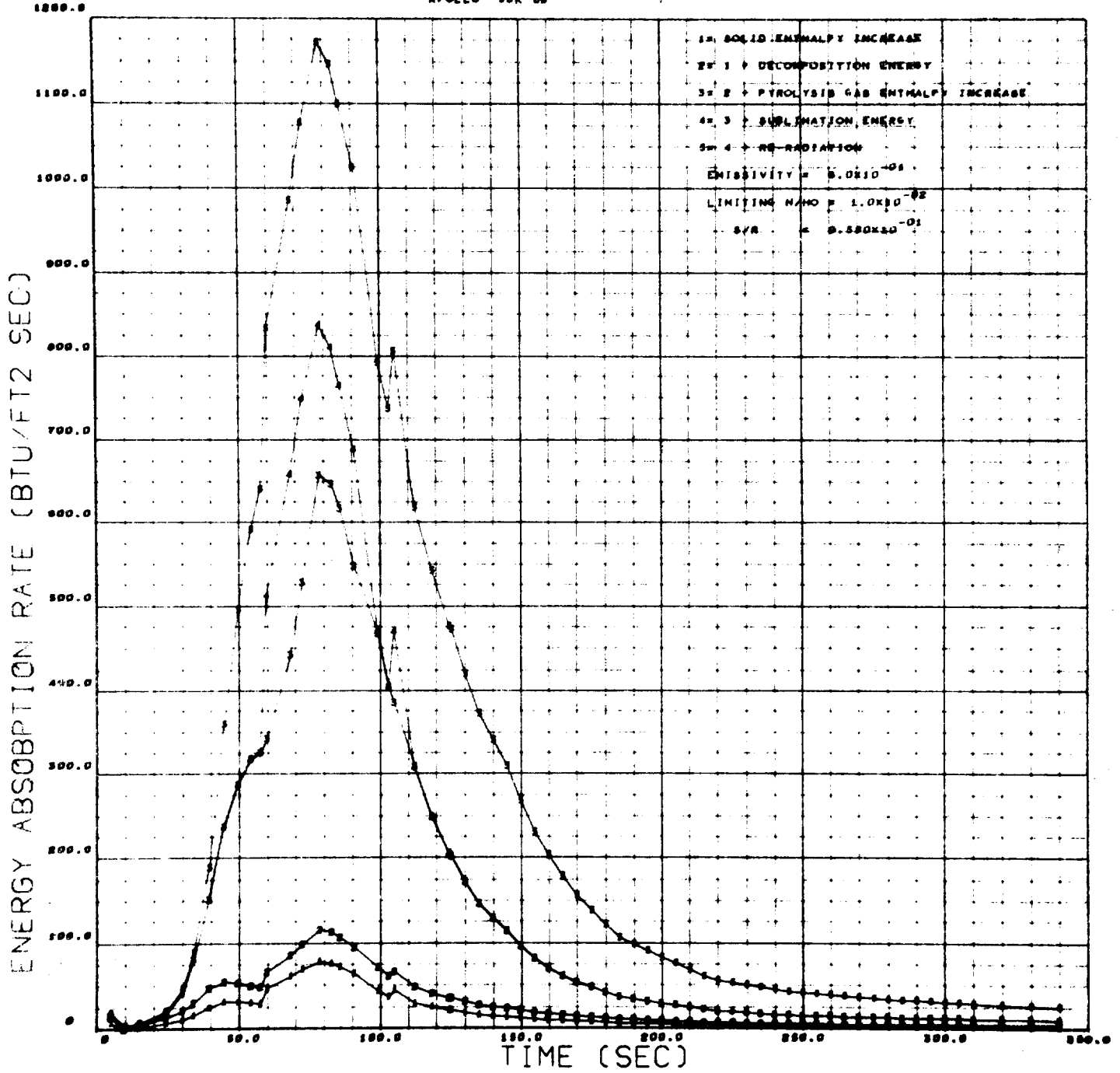


FIGURE A 75

HEATING RATE HISTORY

APOLLO 30K UB

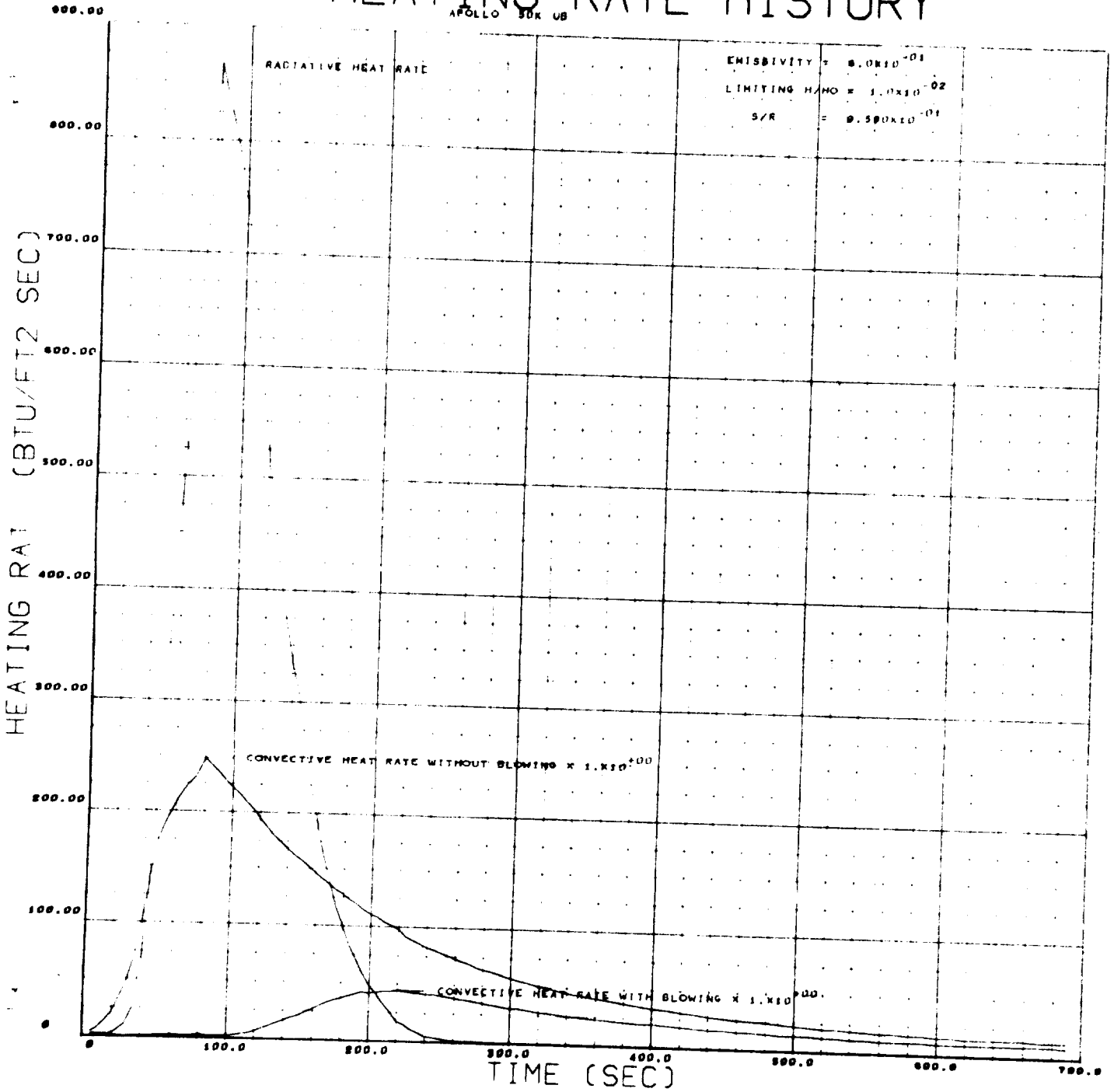


FIGURE A 95

MATERIAL RESPONSE DATA

APOLLO SUB US

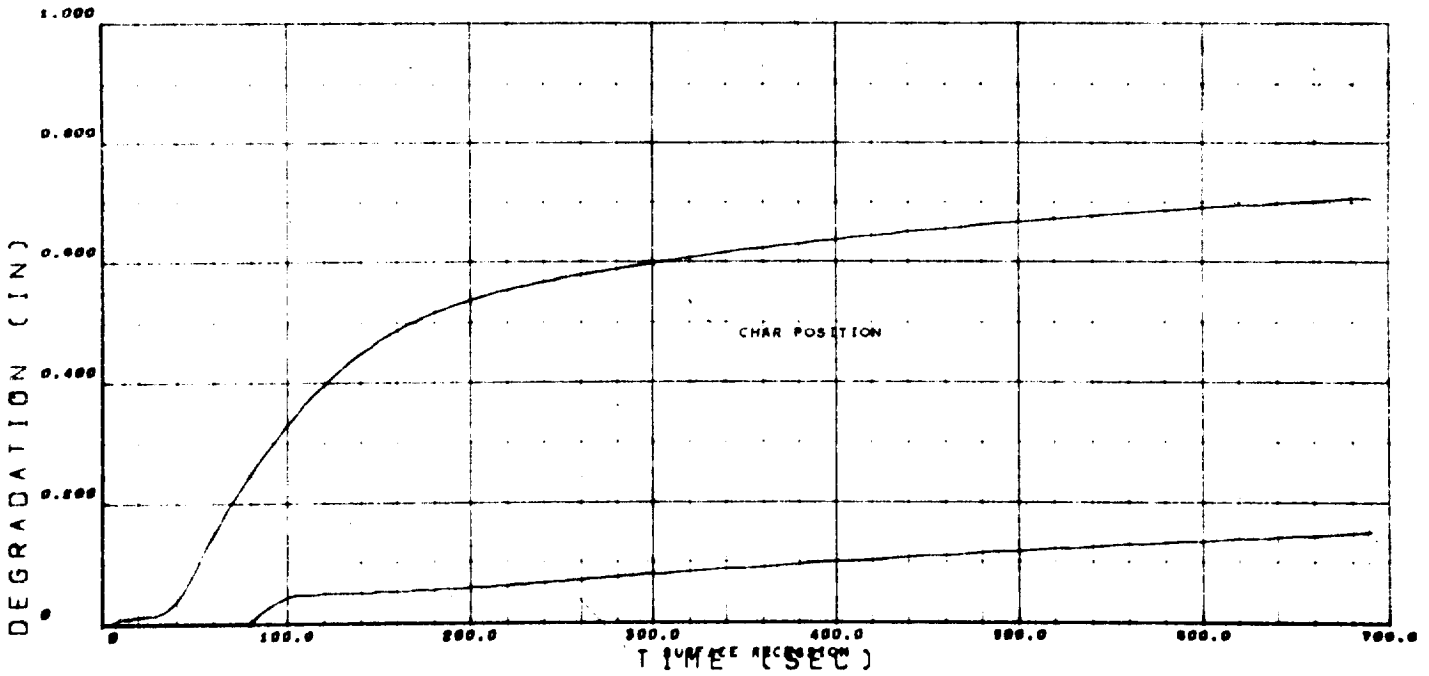
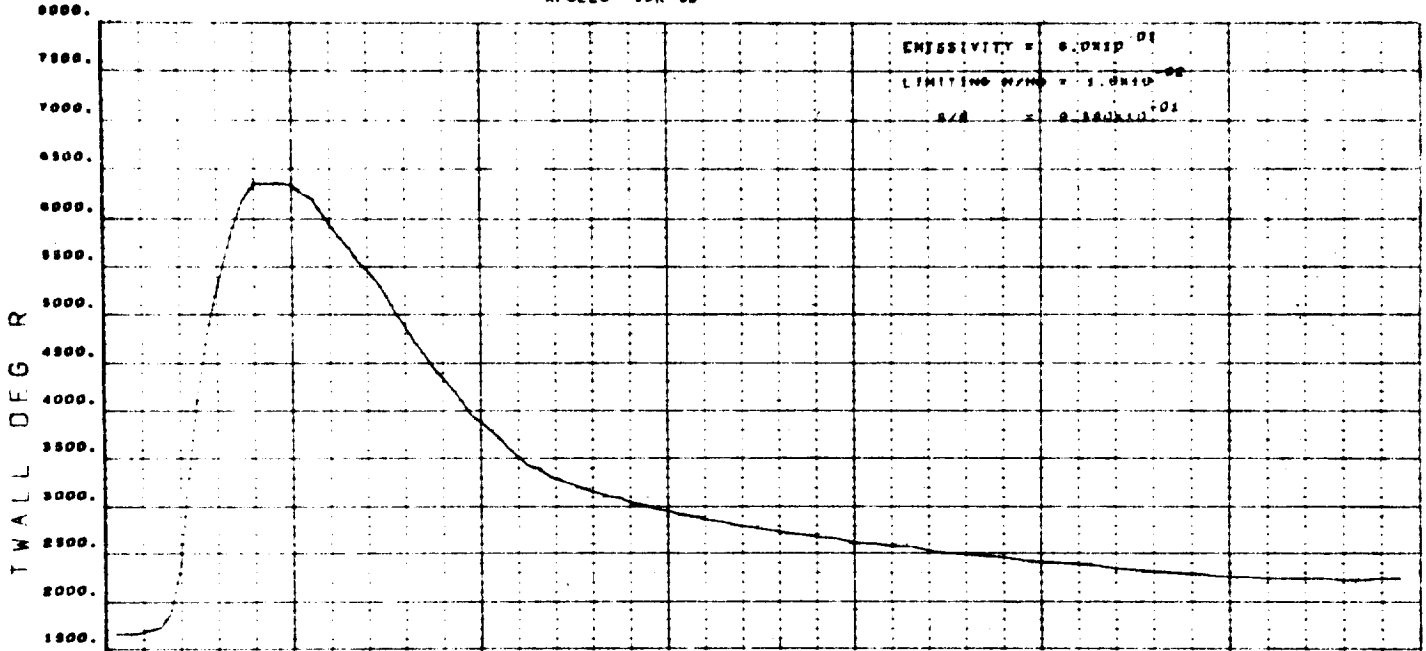


FIGURE A 75

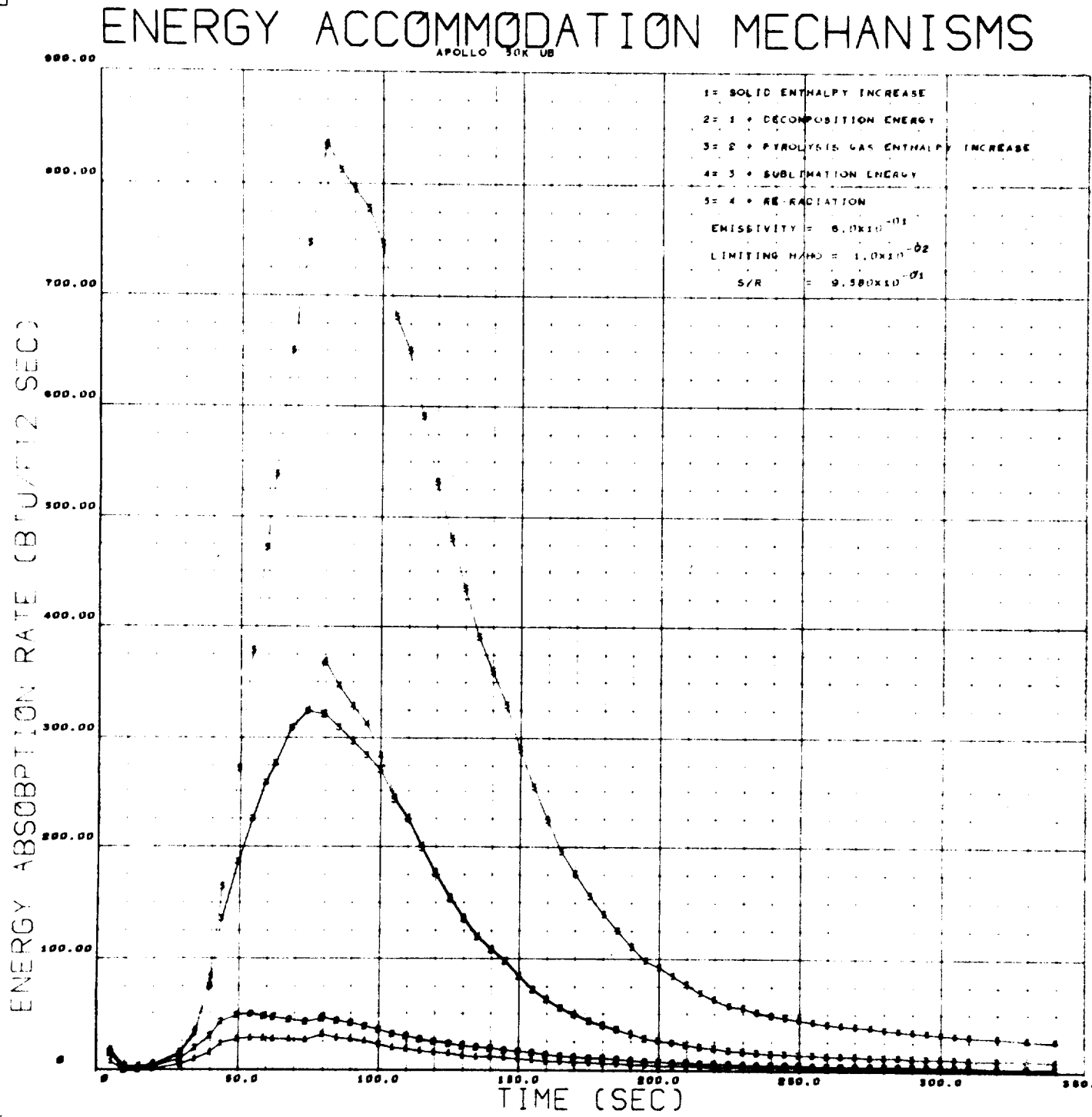


FIGURE A 76

HEATING RATE HISTORY

APOLLO 30K UB

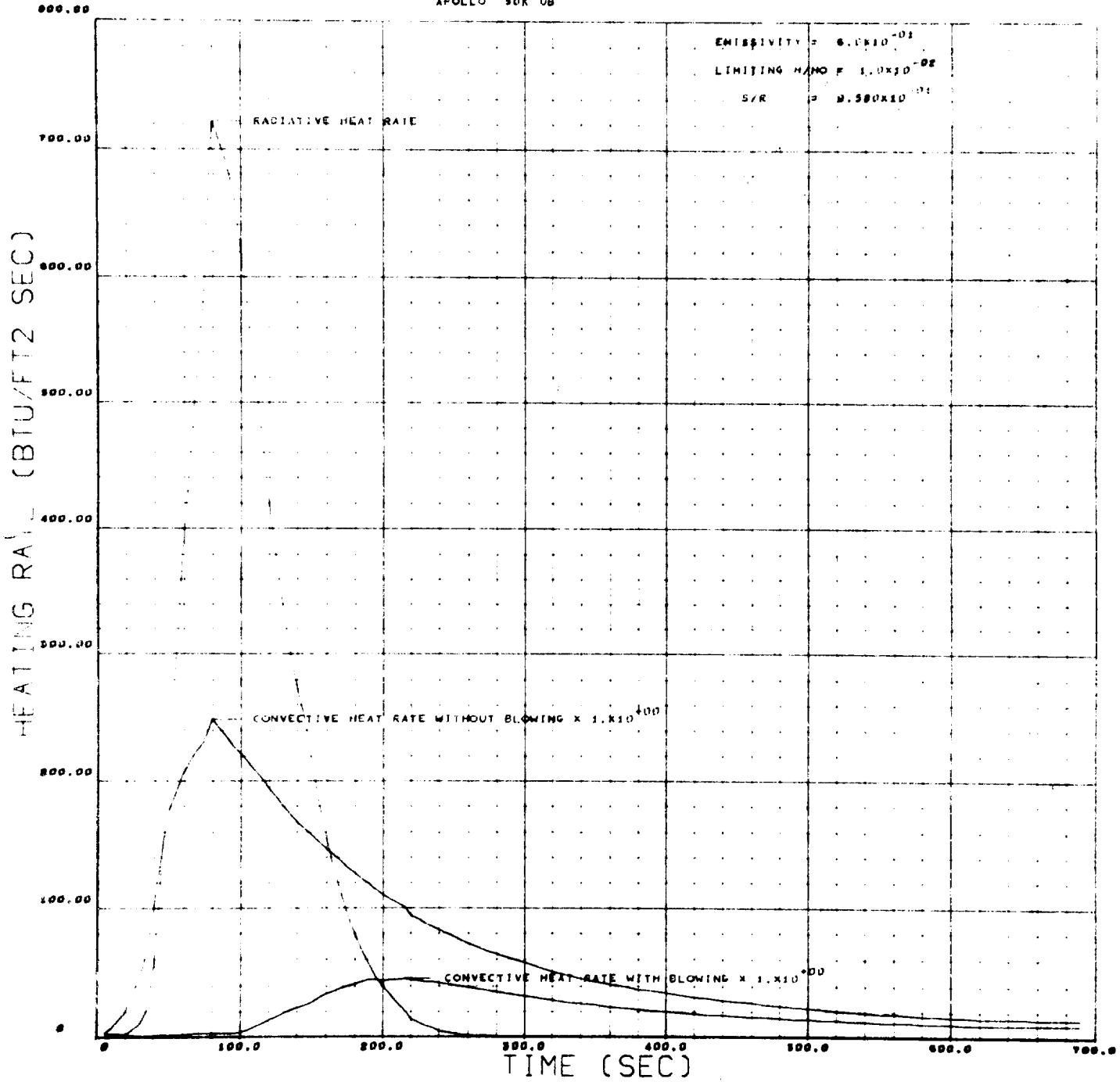


FIGURE A 76

MATERIAL RESPONSE DATA

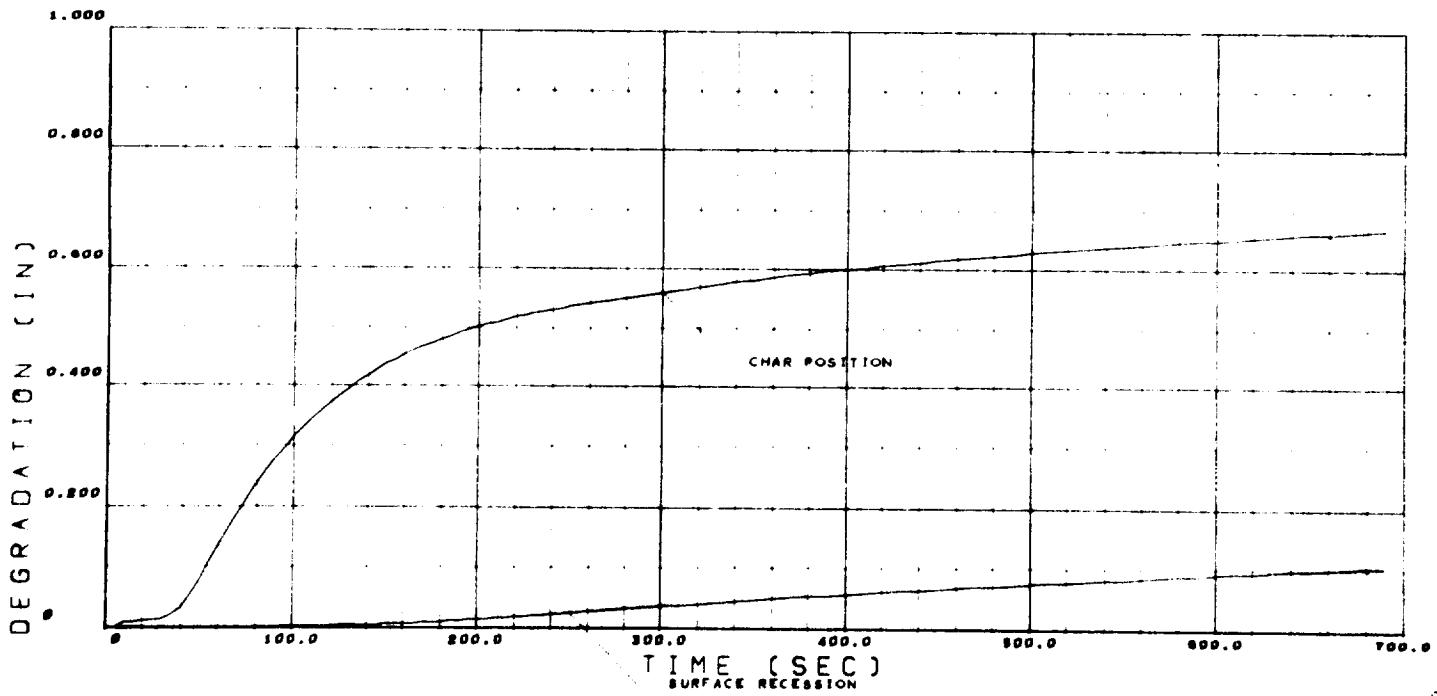
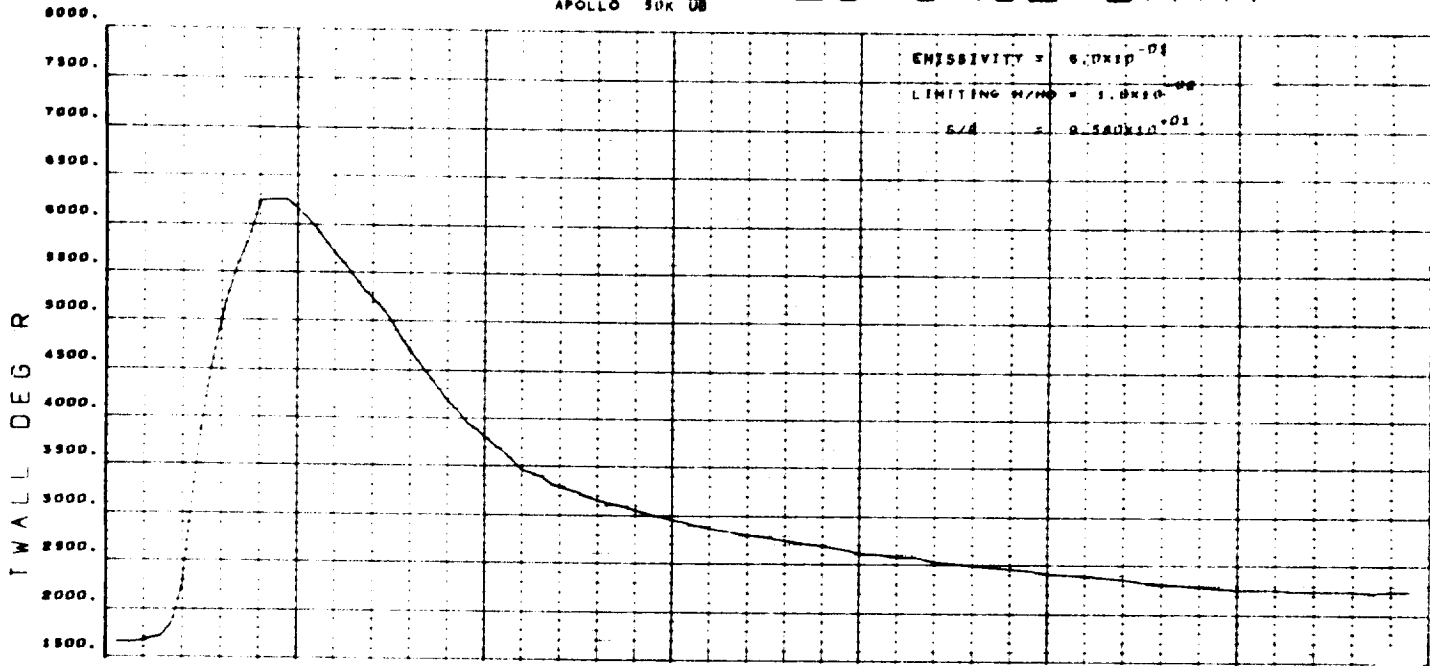


FIGURE A76

ENERGY ACCOMMODATION MECHANISMS

APOLLO 30X UB

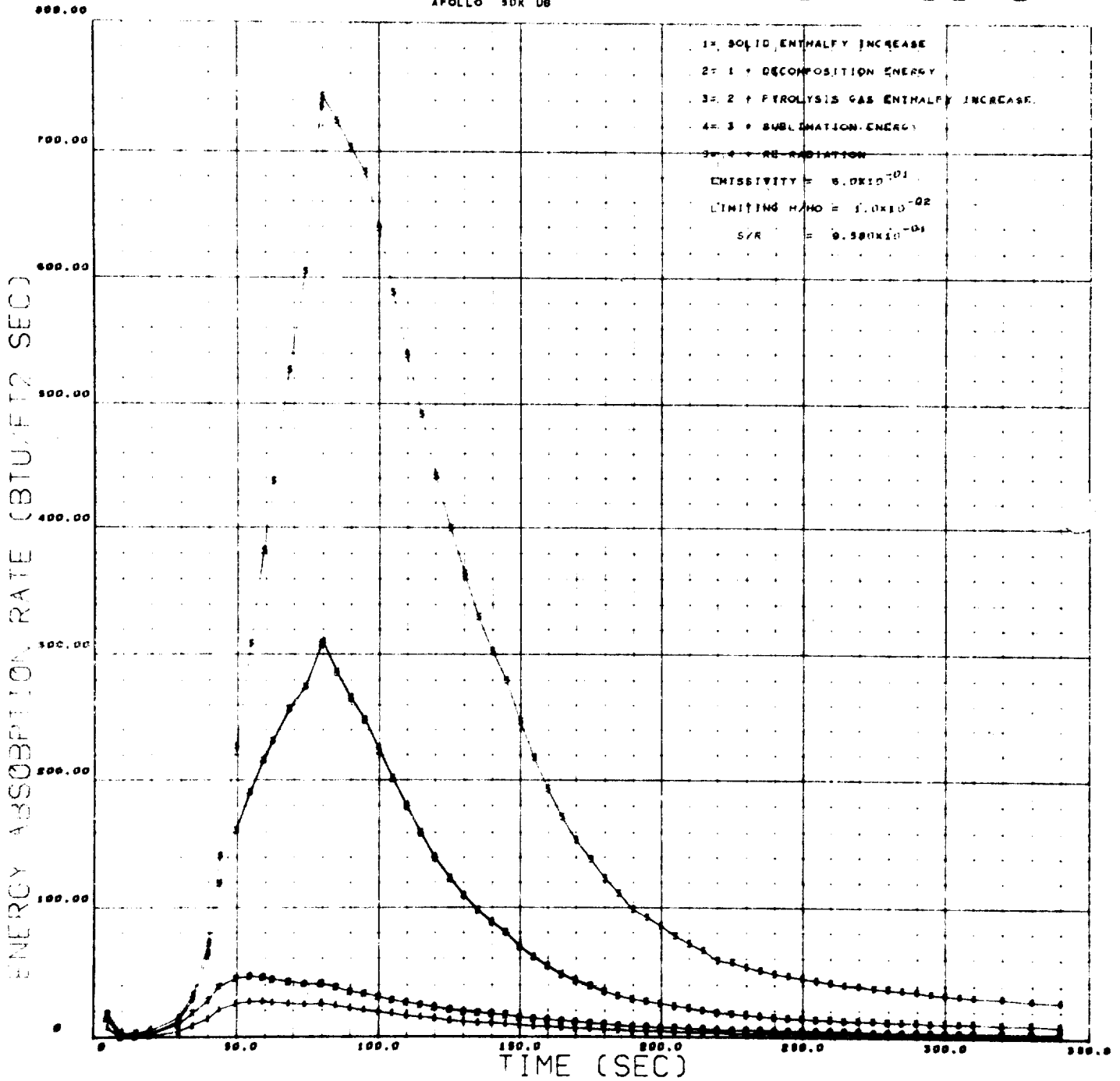


FIGURE A 77

HEATING RATE HISTORY

APOLLO 30K US

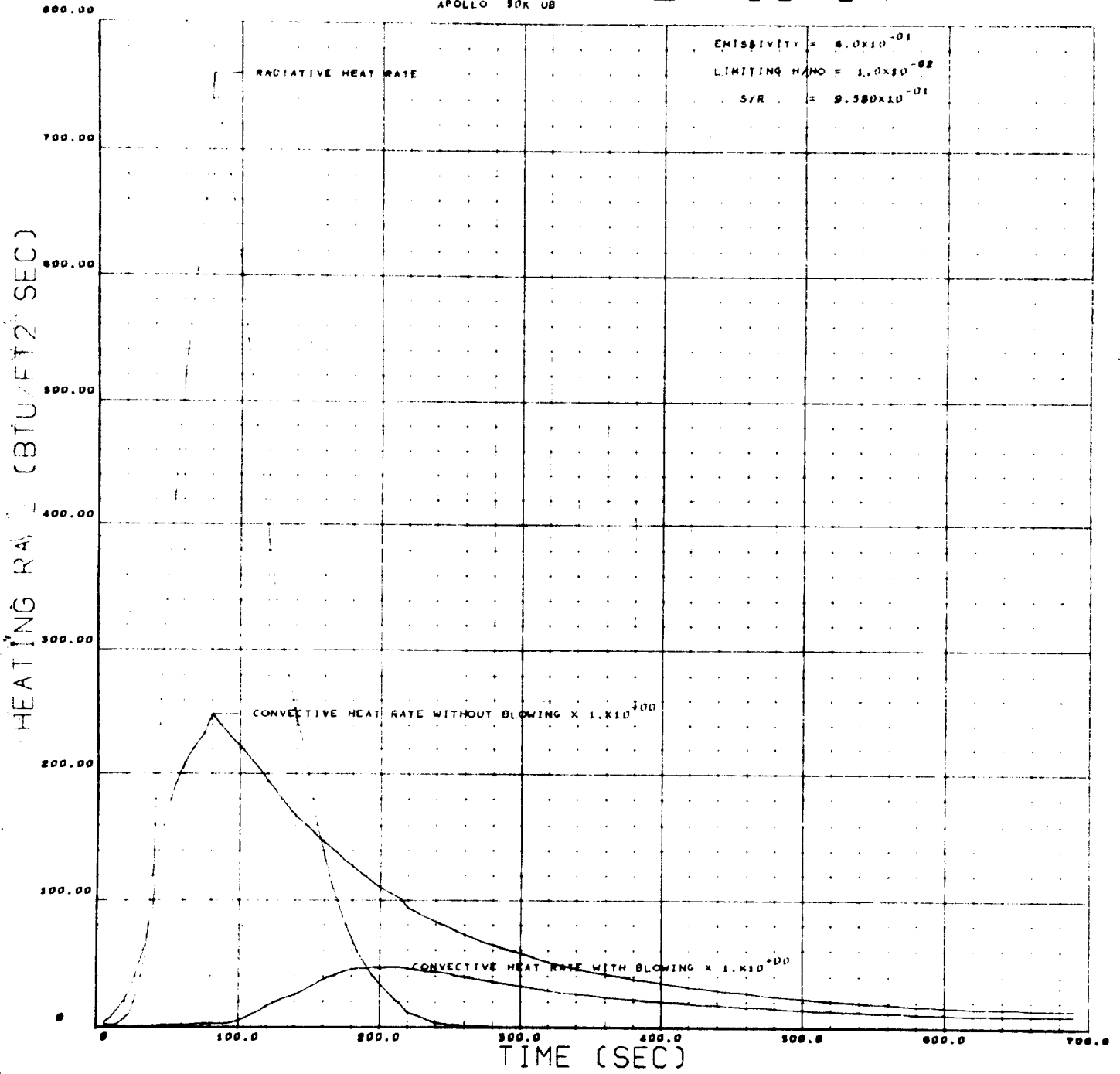


FIGURE A77

MATERIAL RESPONSE DATA

APOLLO 30K UB

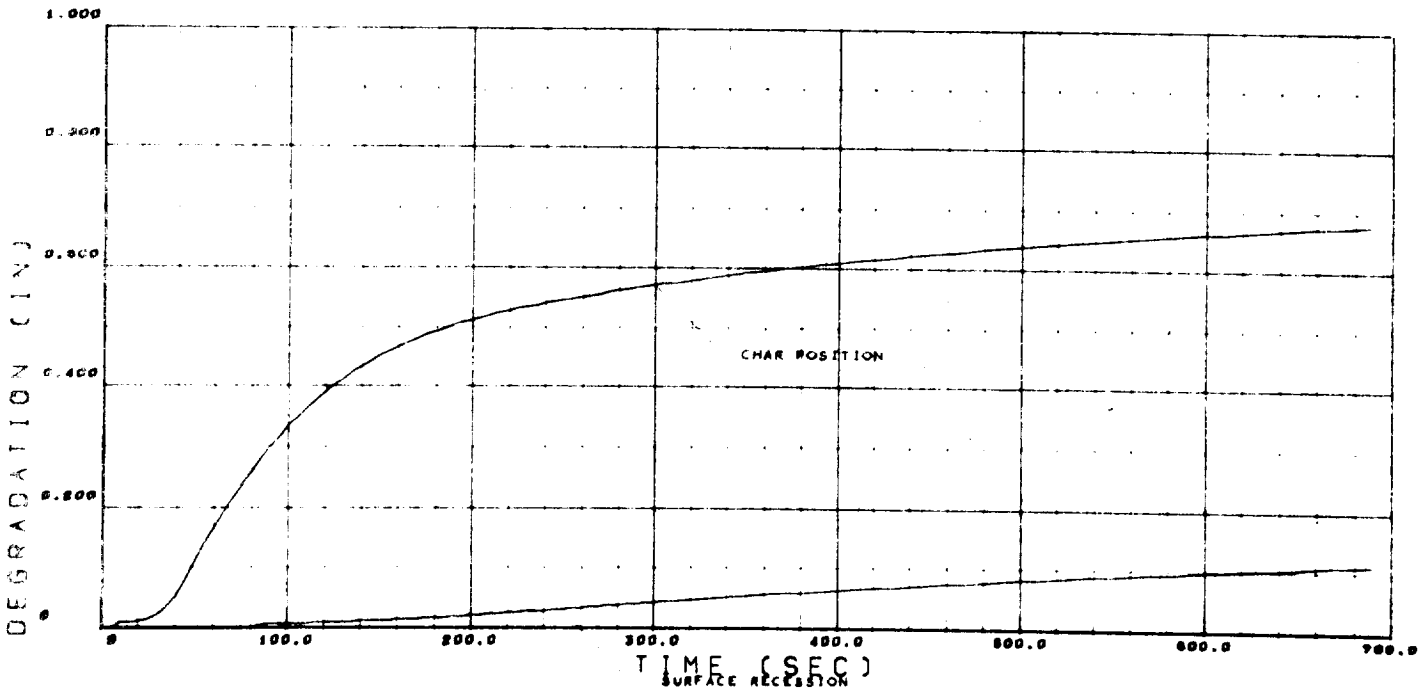
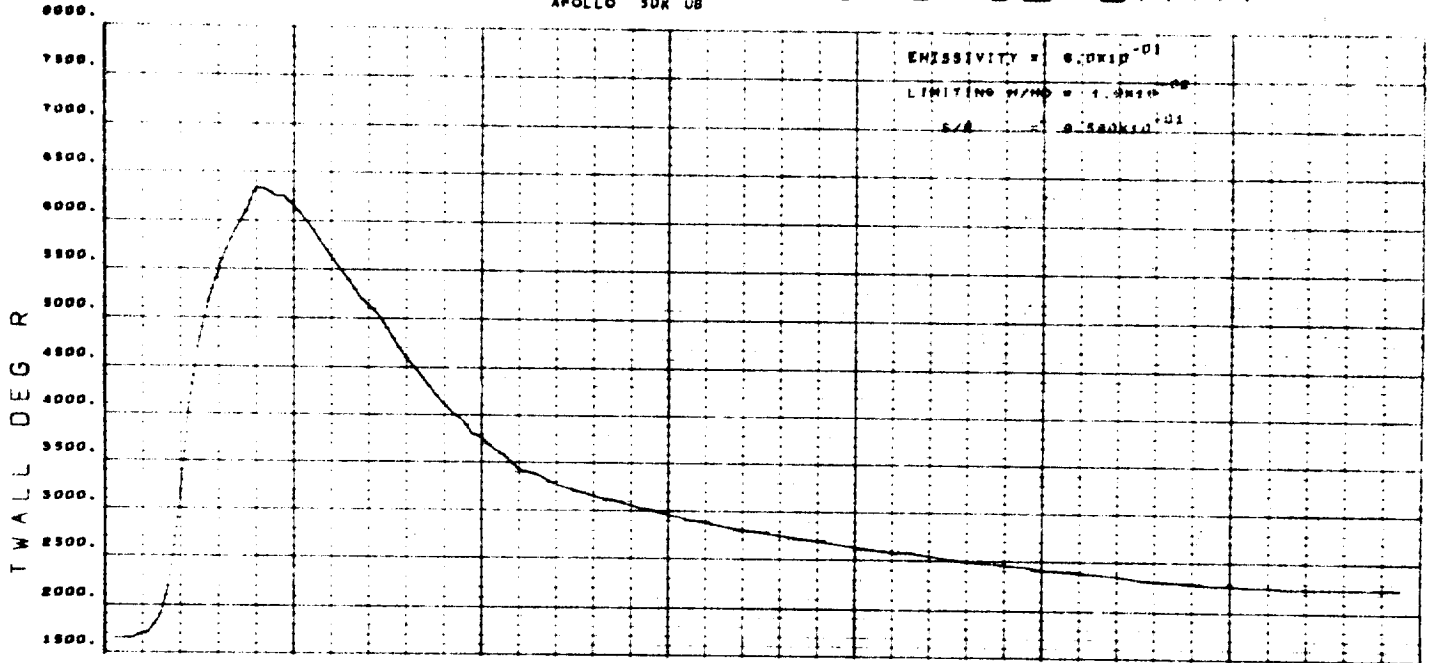


FIGURE A77

ENERGY ACCOMMODATION MECHANISMS

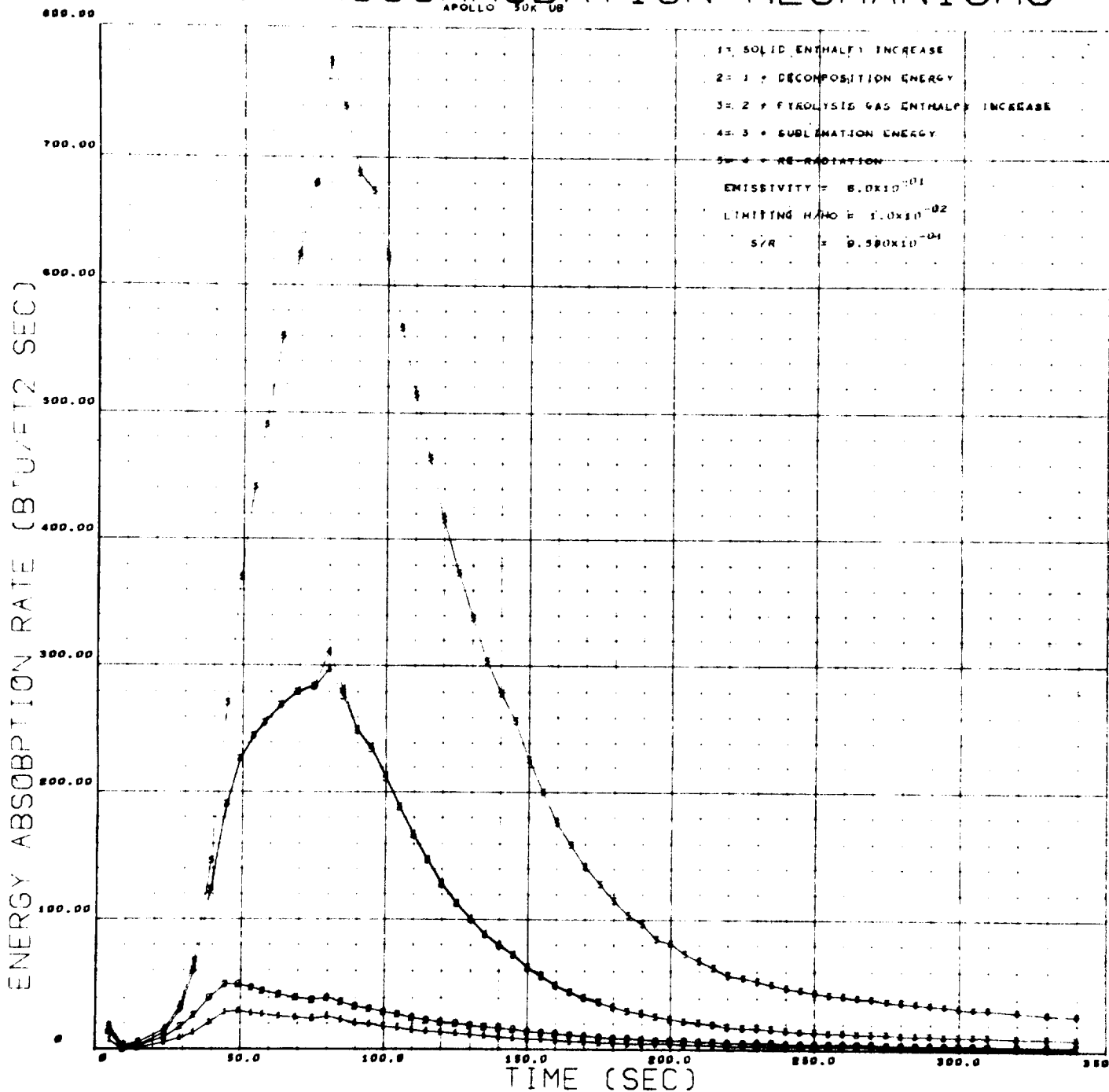


FIGURE A78

HEATING RATE HISTORY

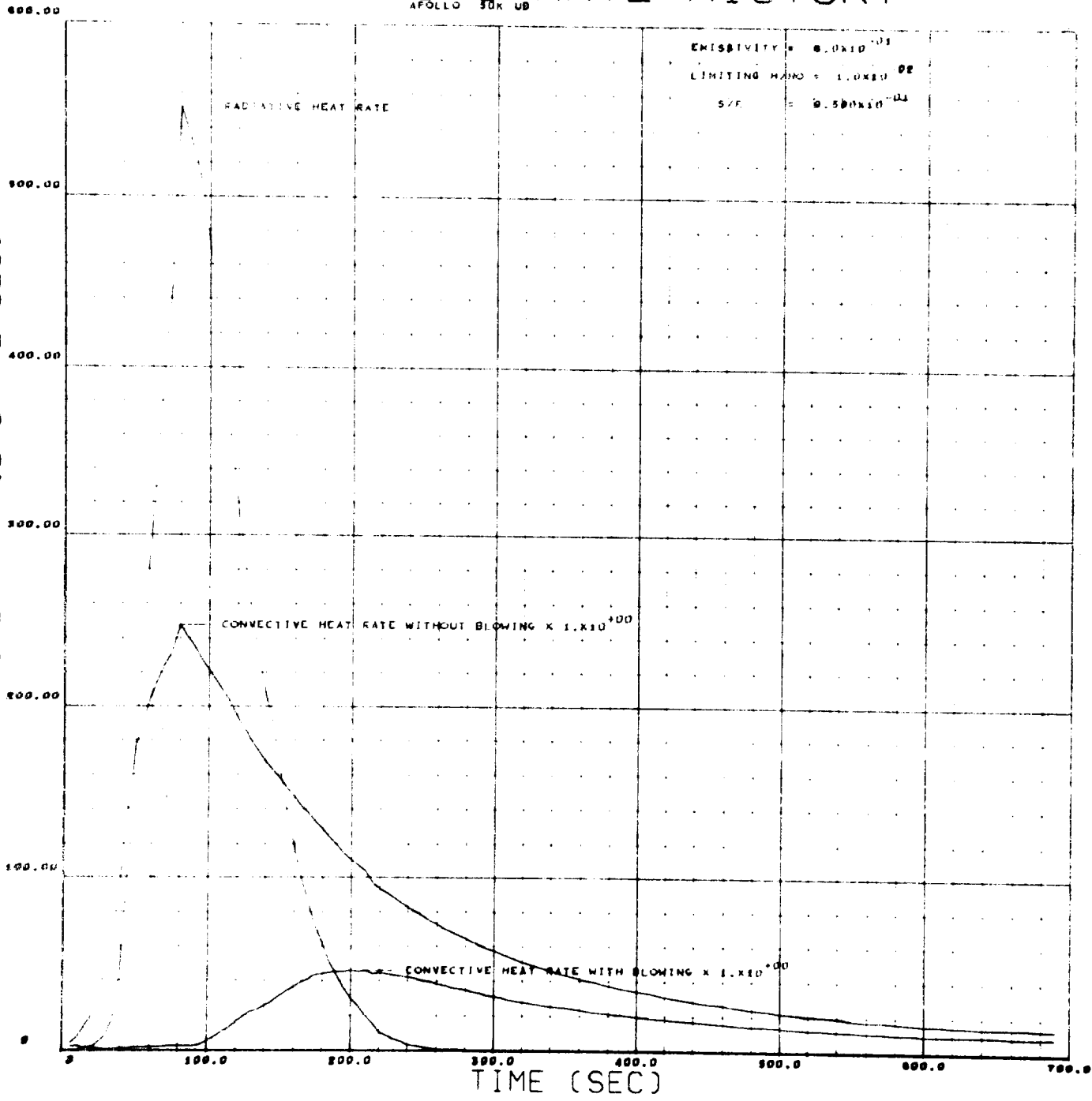


FIGURE A 78

MATERIAL RESPONSE DATA

APOLLO 30K UB

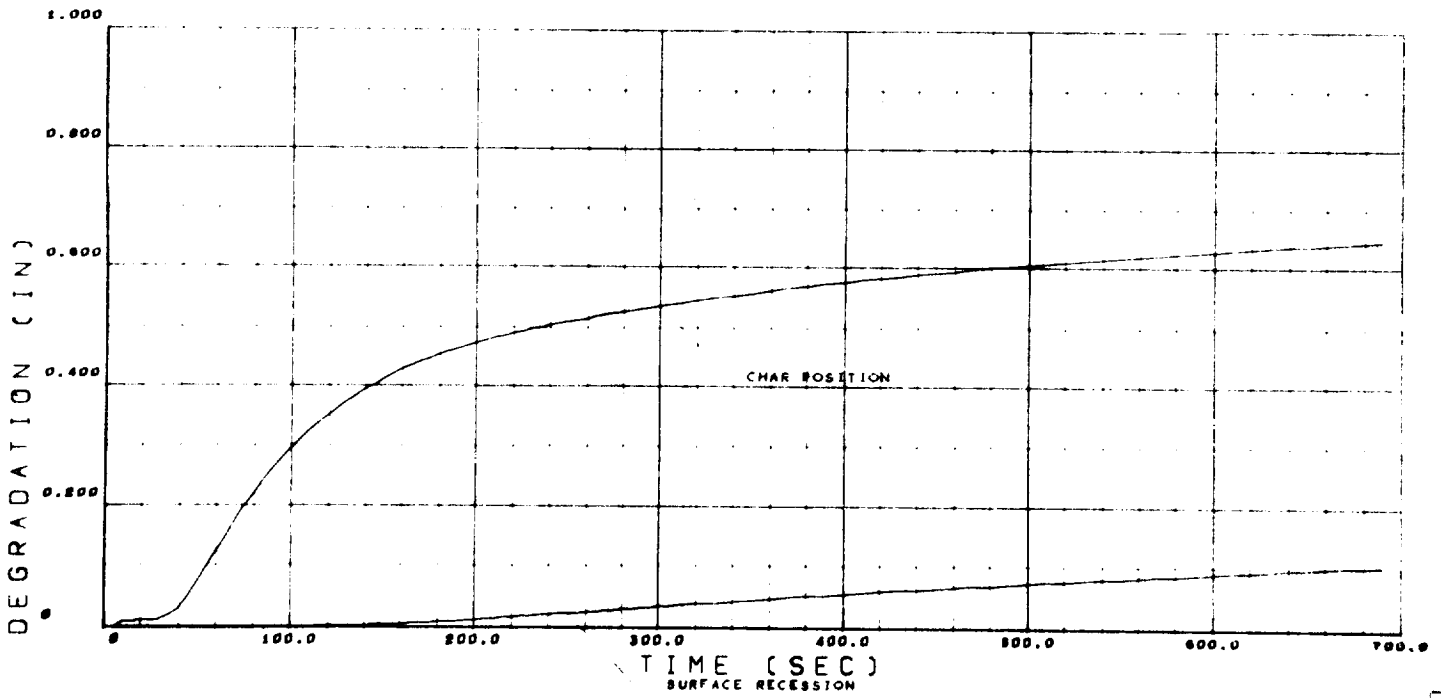
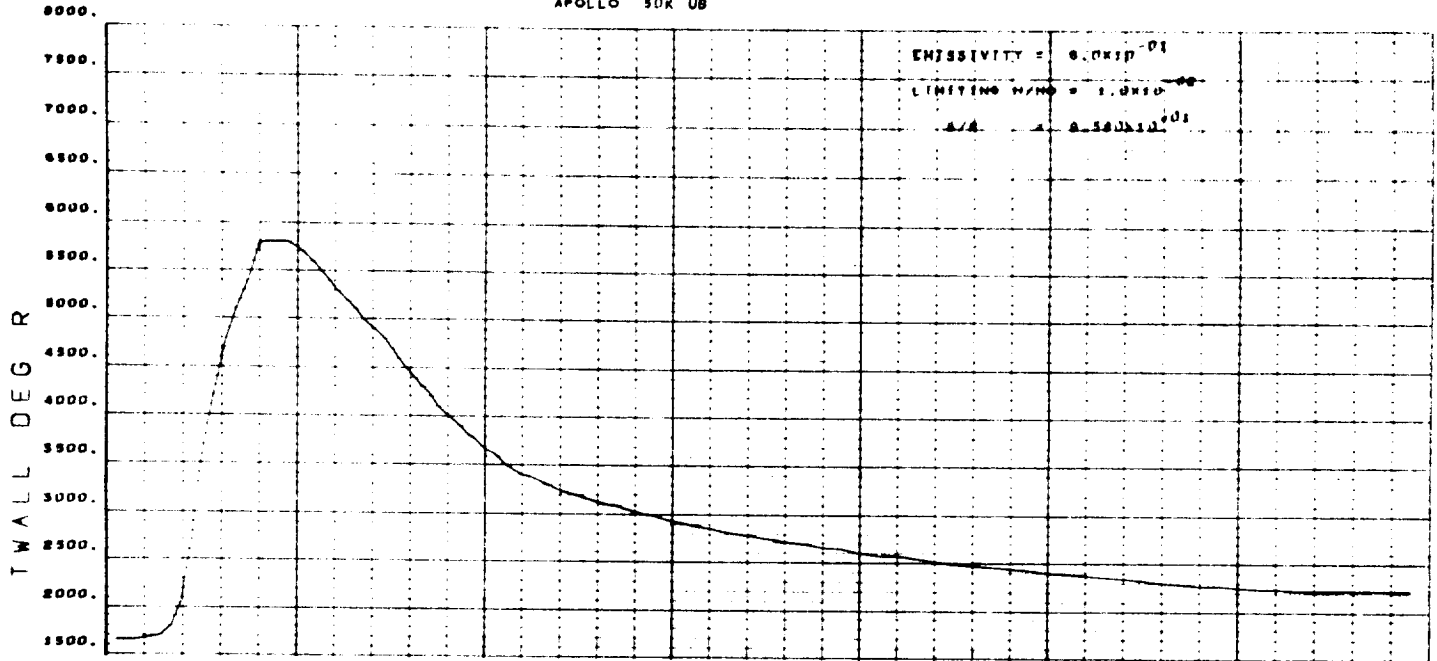


FIGURE A78

ENERGY ACCOMMODATION MECHANISMS

APOLLO 10R UB

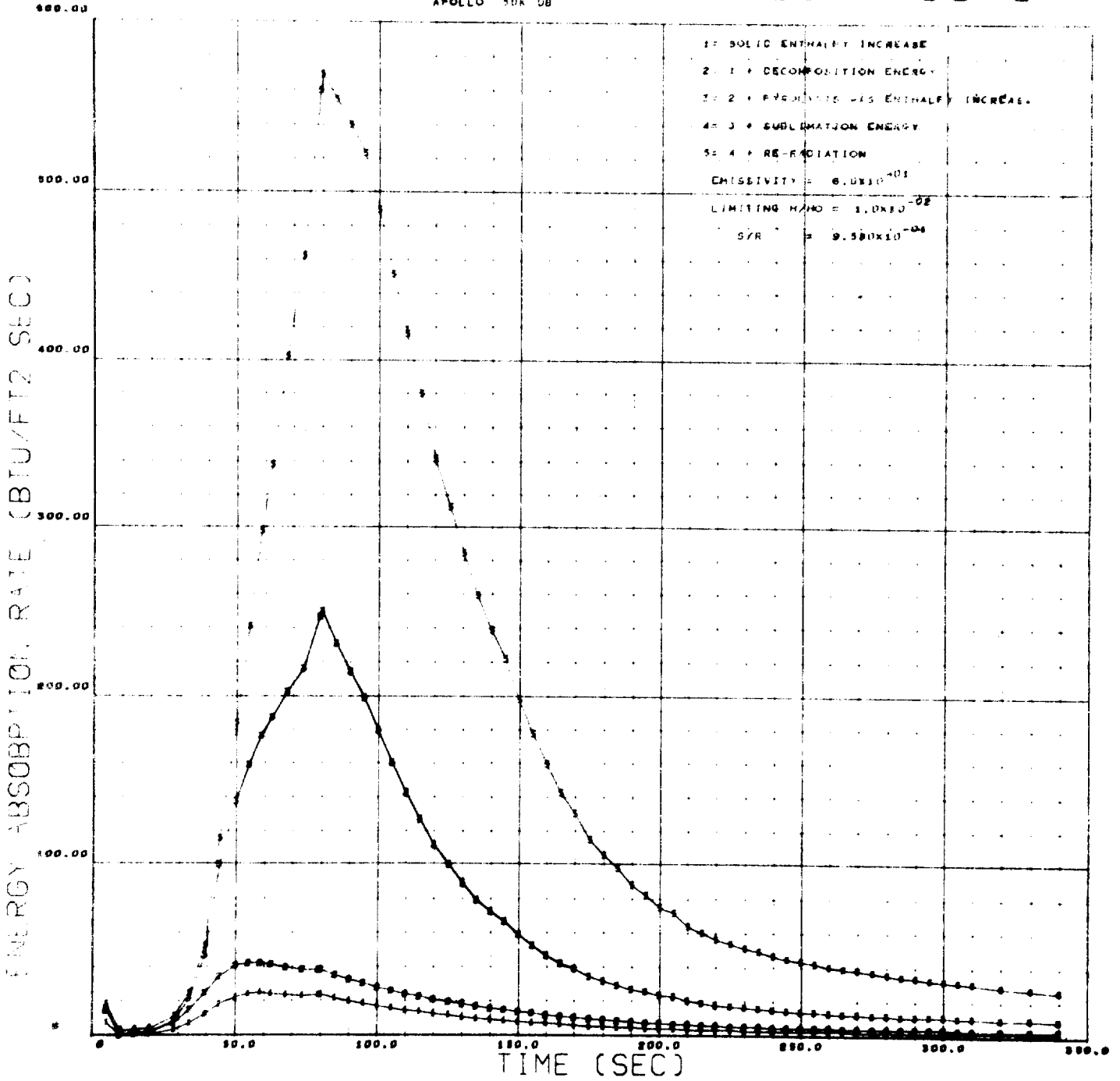


FIGURE A 79

HEATING RATE HISTORY

APOLLO 10K US

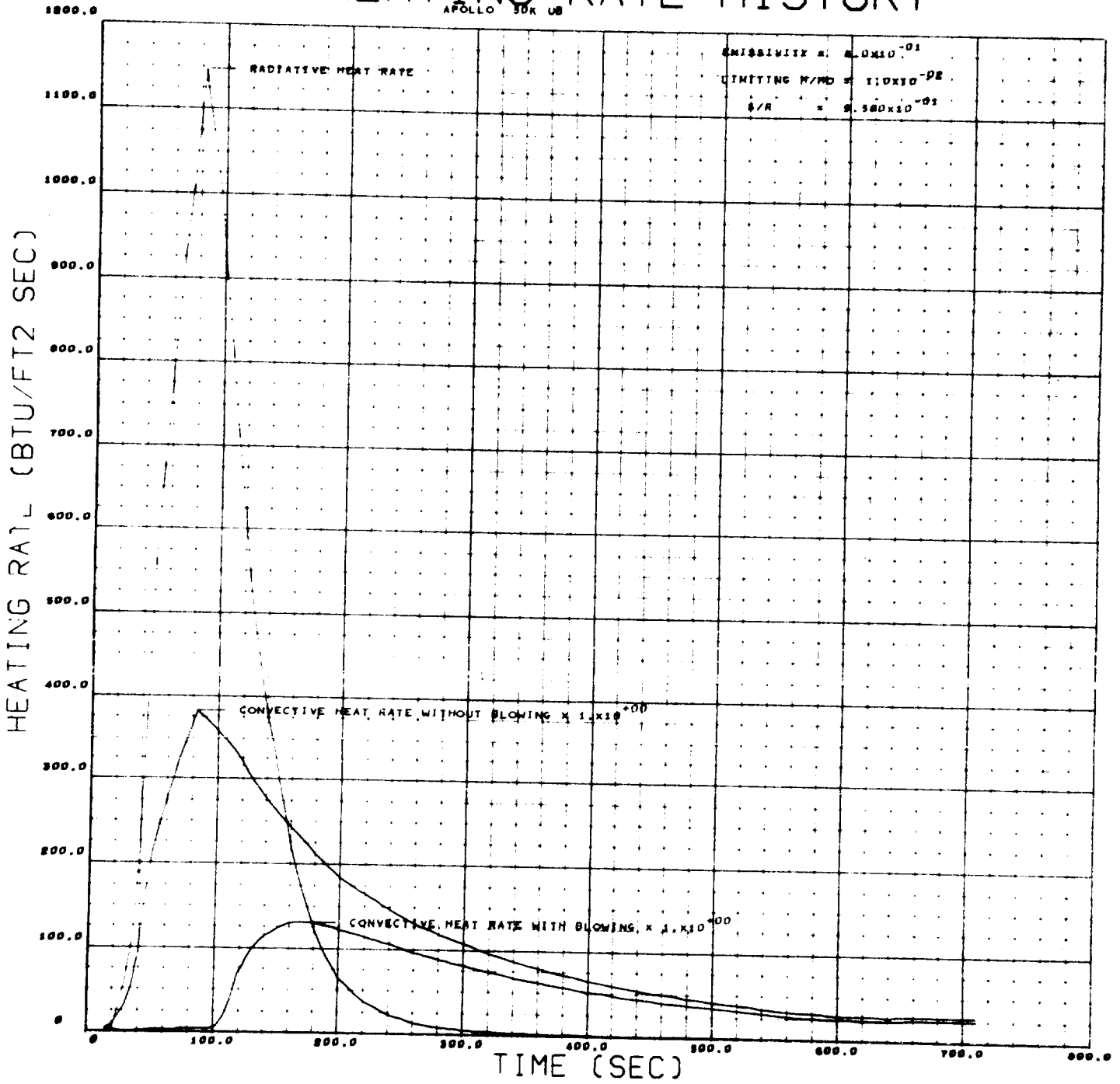


FIGURE A7A

MATERIAL RESPONSE DATA

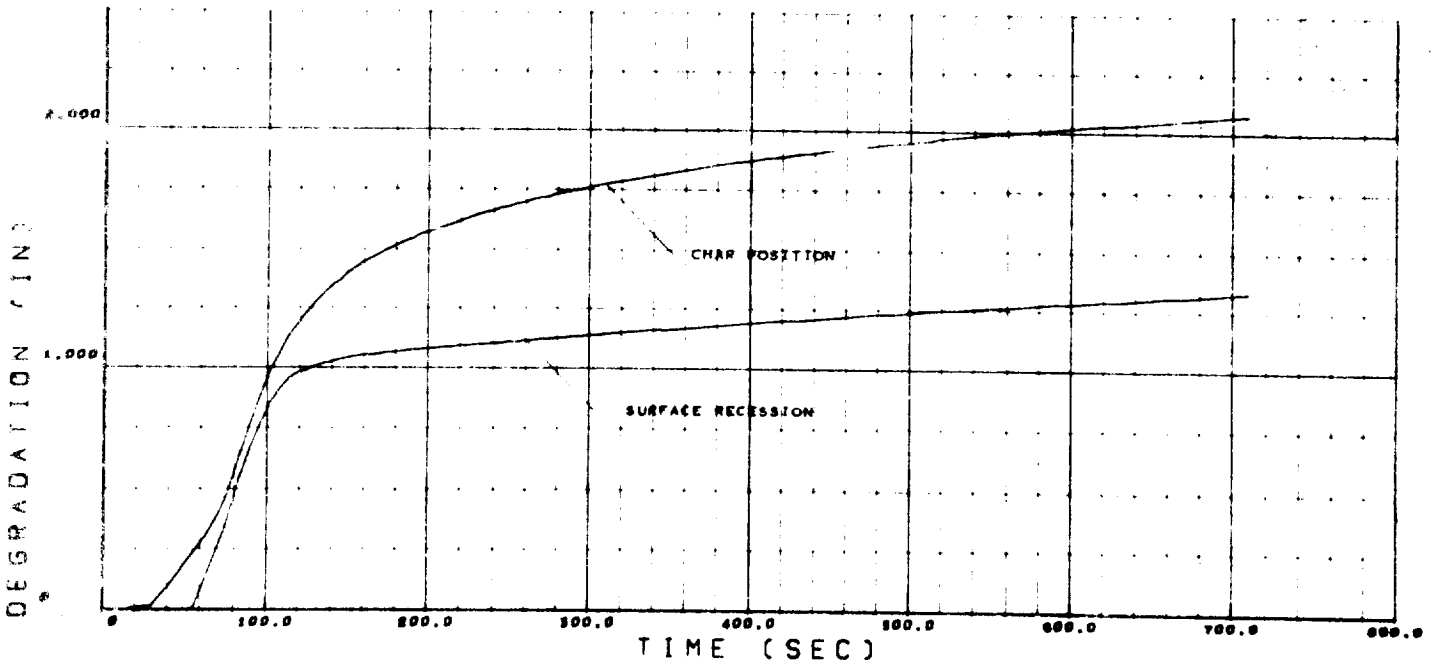
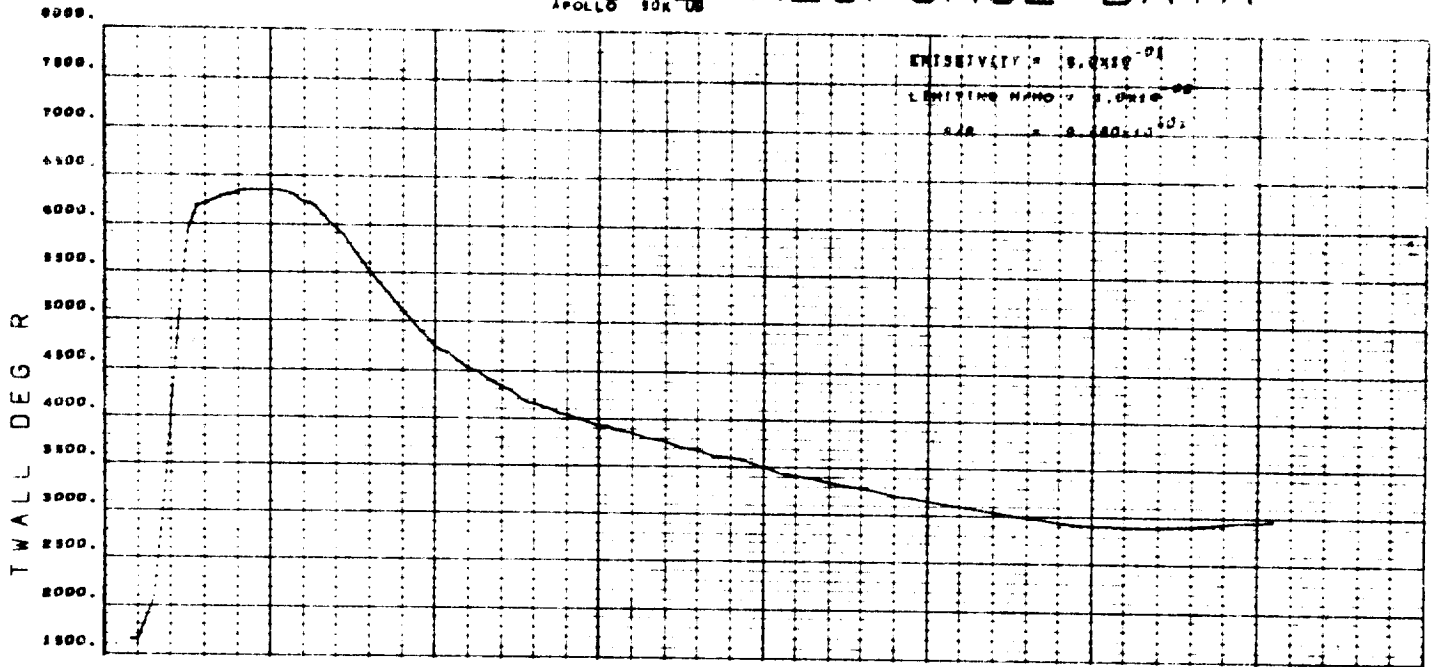


FIGURE A7A

ENERGY ACCOMMODATION MECHANISMS

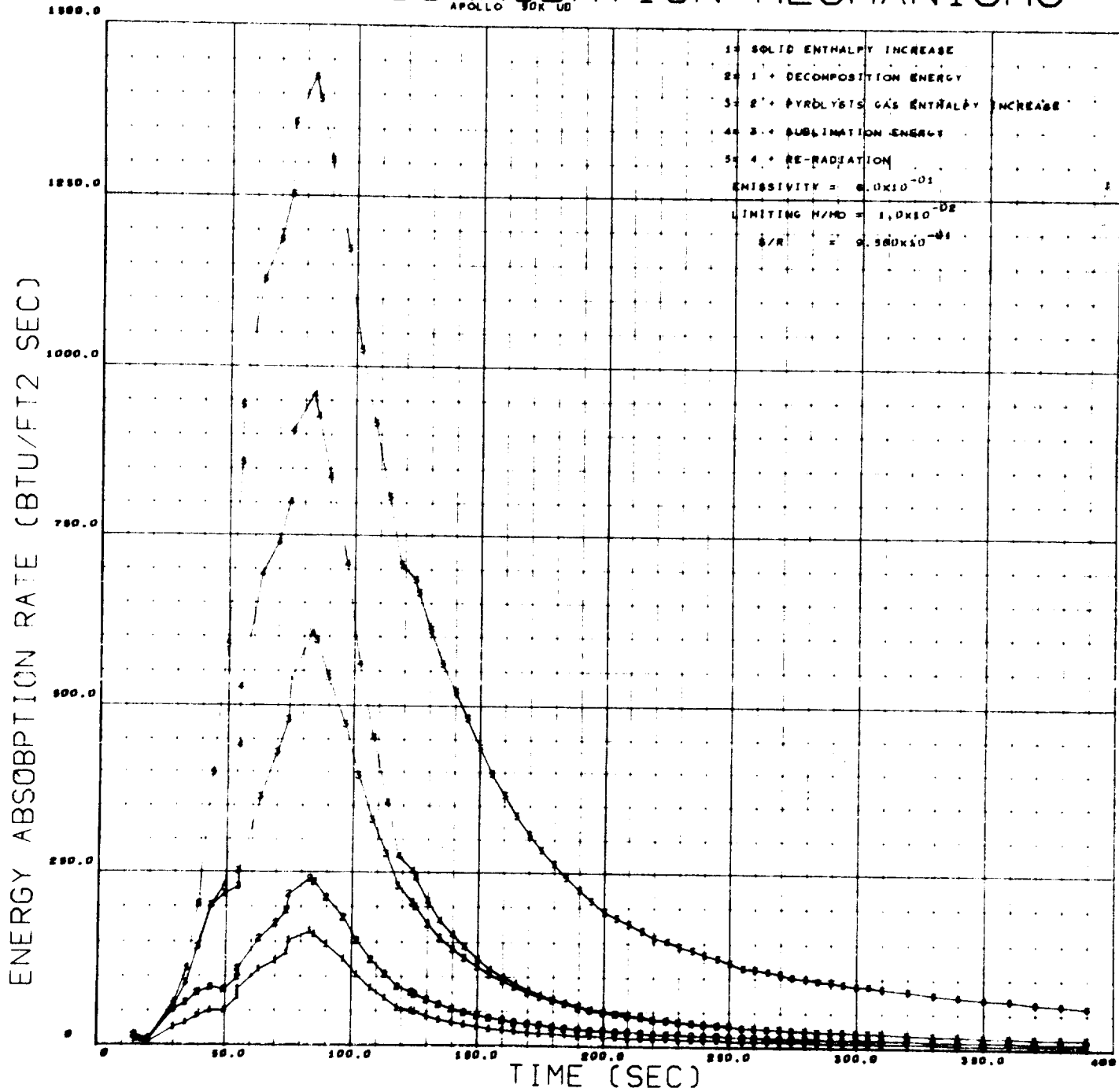


FIGURE A 80

HEATING RATE HISTORY

APOLLO 80X 48

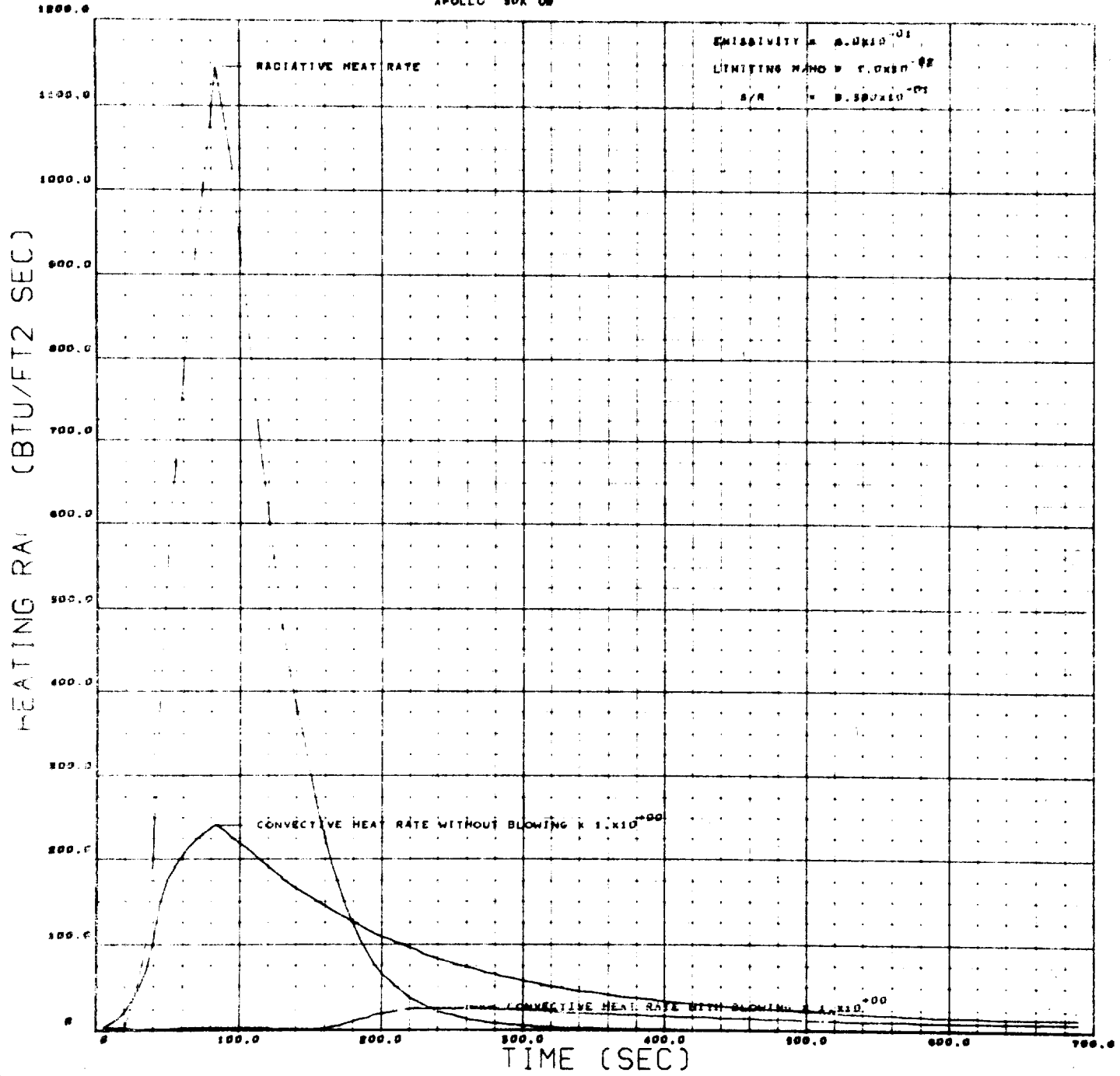


FIGURE A 80

MATERIAL RESPONSE DATA

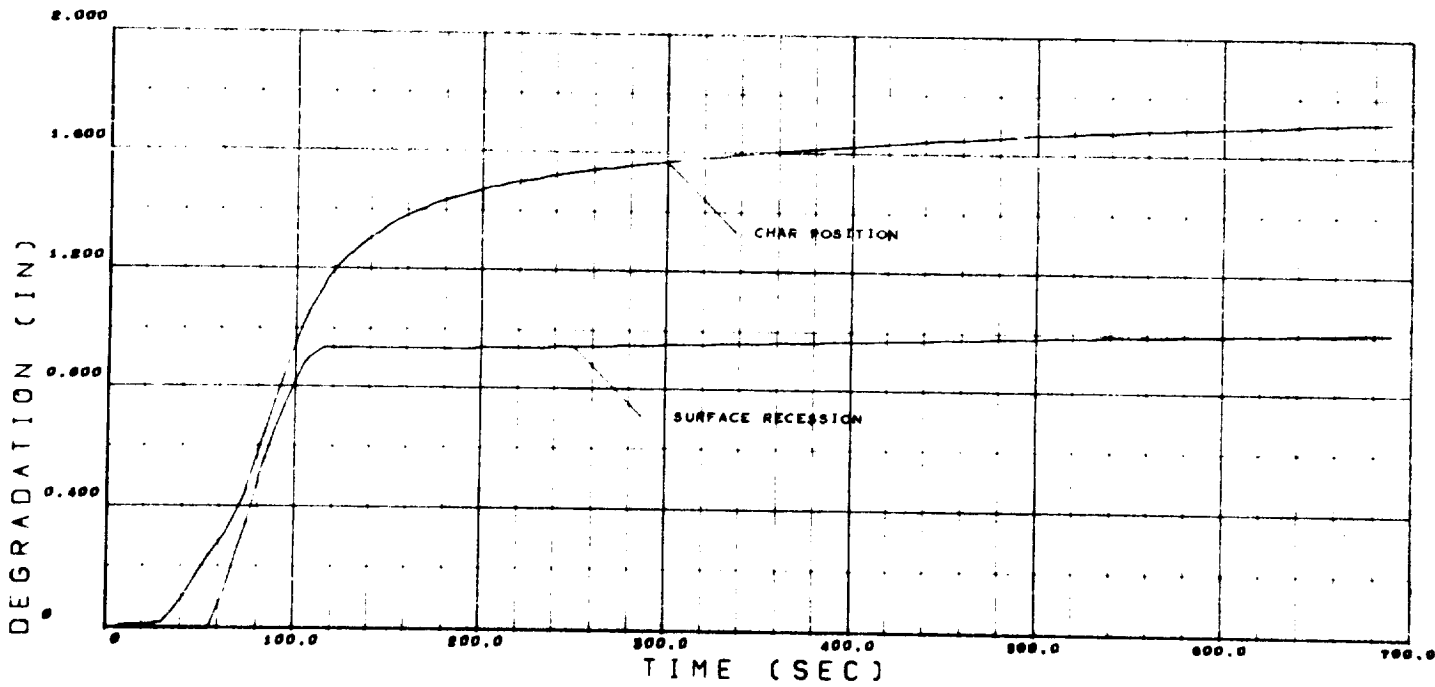
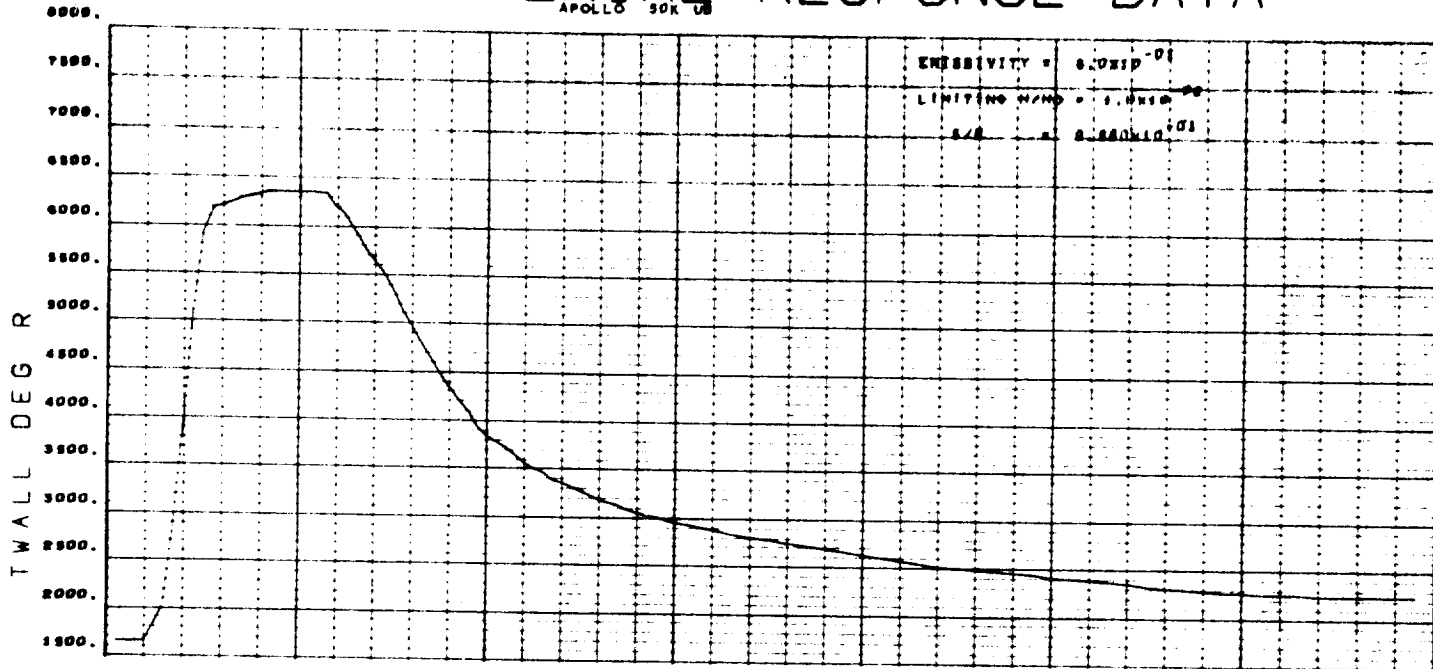


FIGURE A 80

ENERGY ACCOMMODATION MECHANISMS

APOLLO FOR US

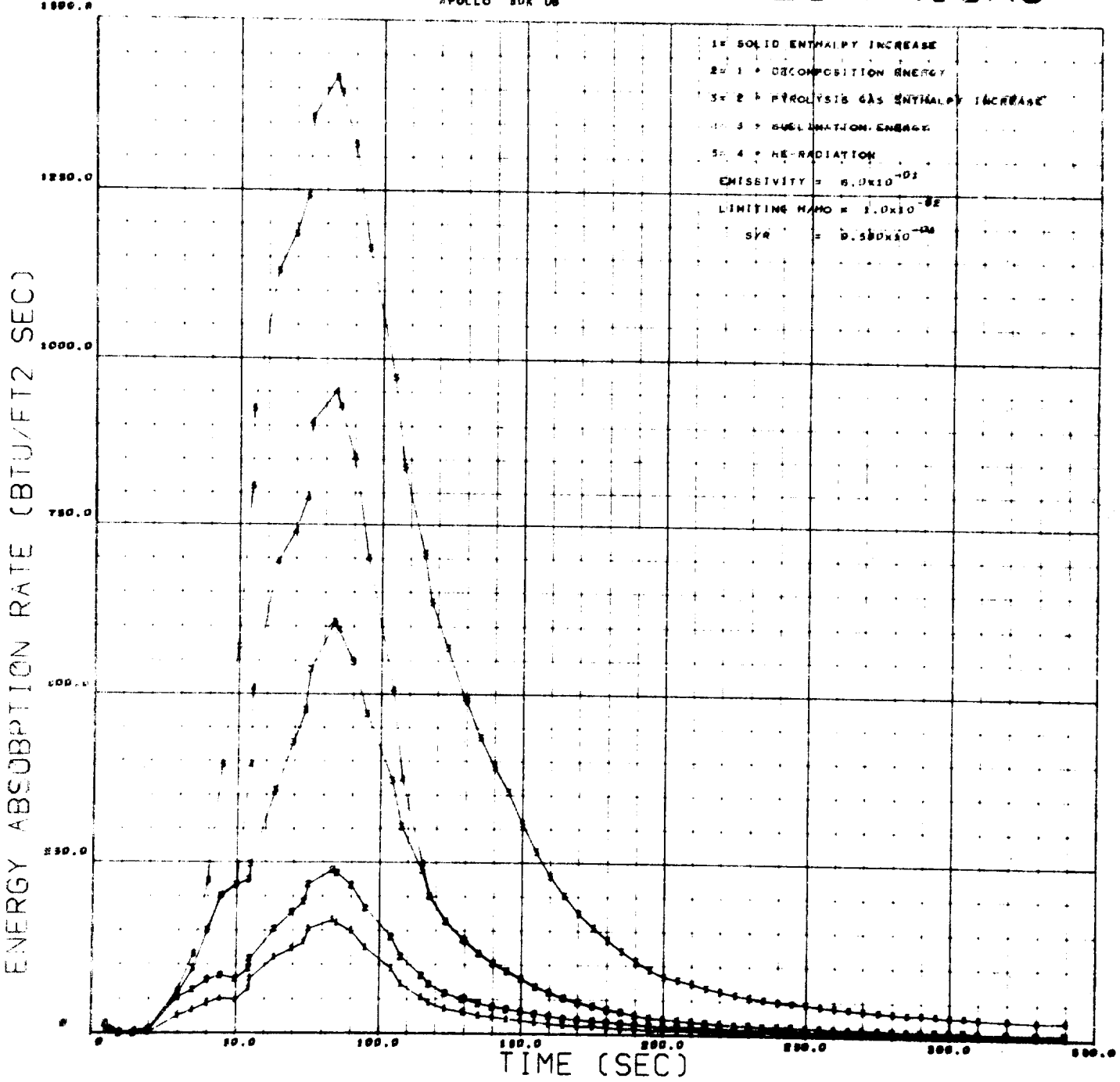


FIGURE A81

HEATING RATE HISTORY

APOLLO STR UB

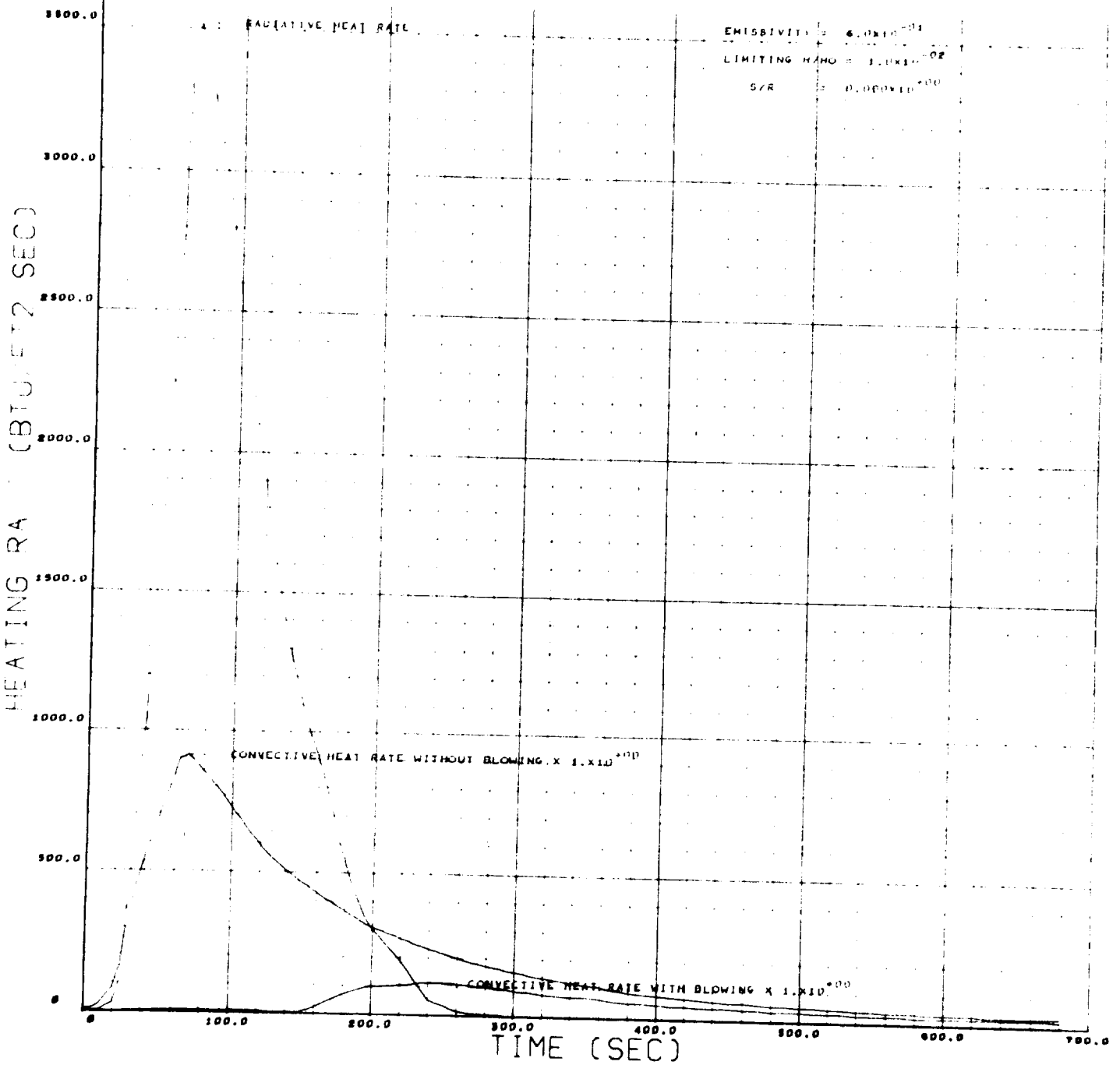


FIGURE A 81

MATERIAL RESPONSE DATA

APOLLO 57K UB

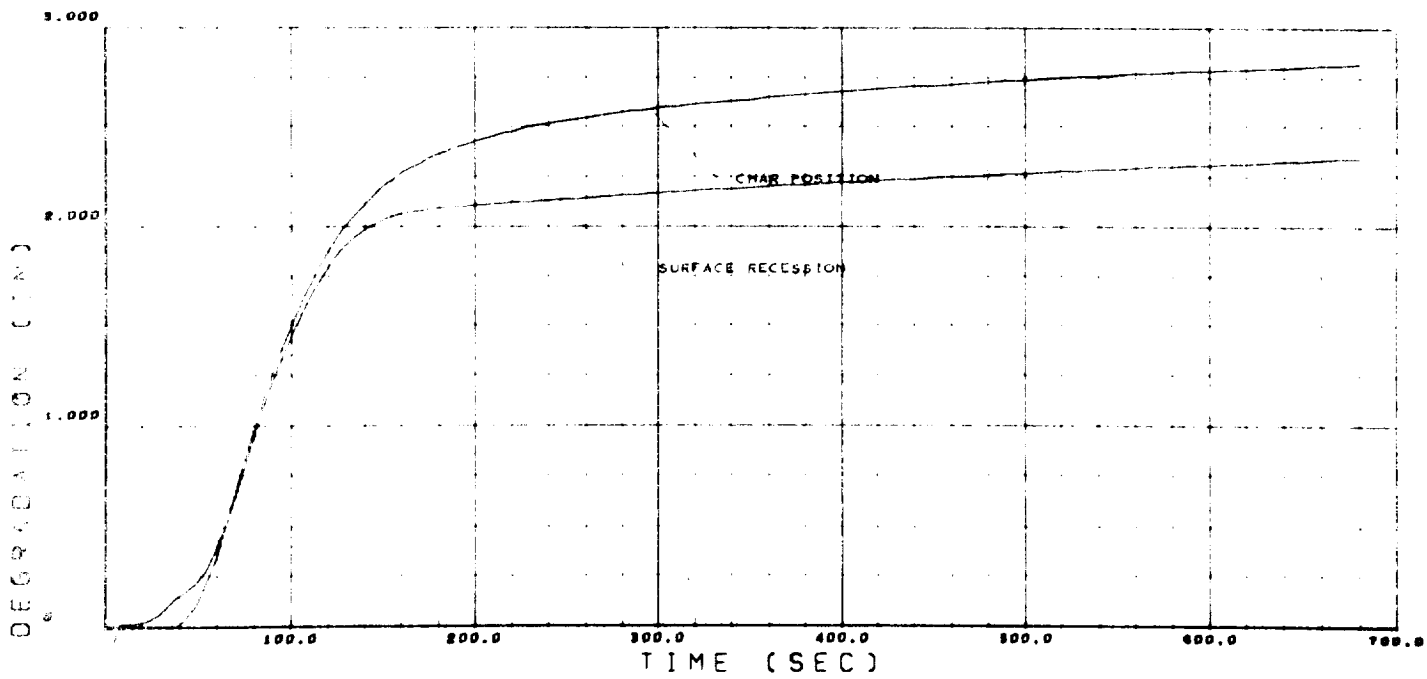
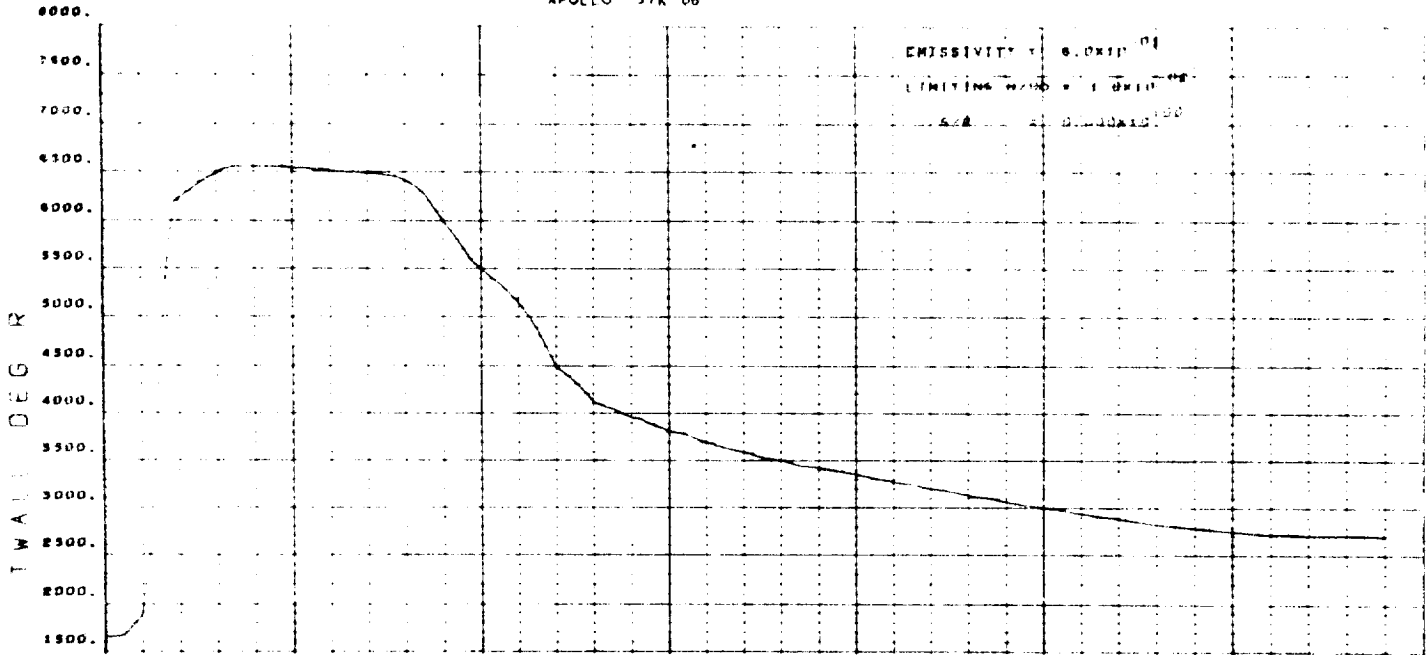


FIGURE A81

ENERGY ACCOMMODATION MECHANISMS

APOLLO 37K UB

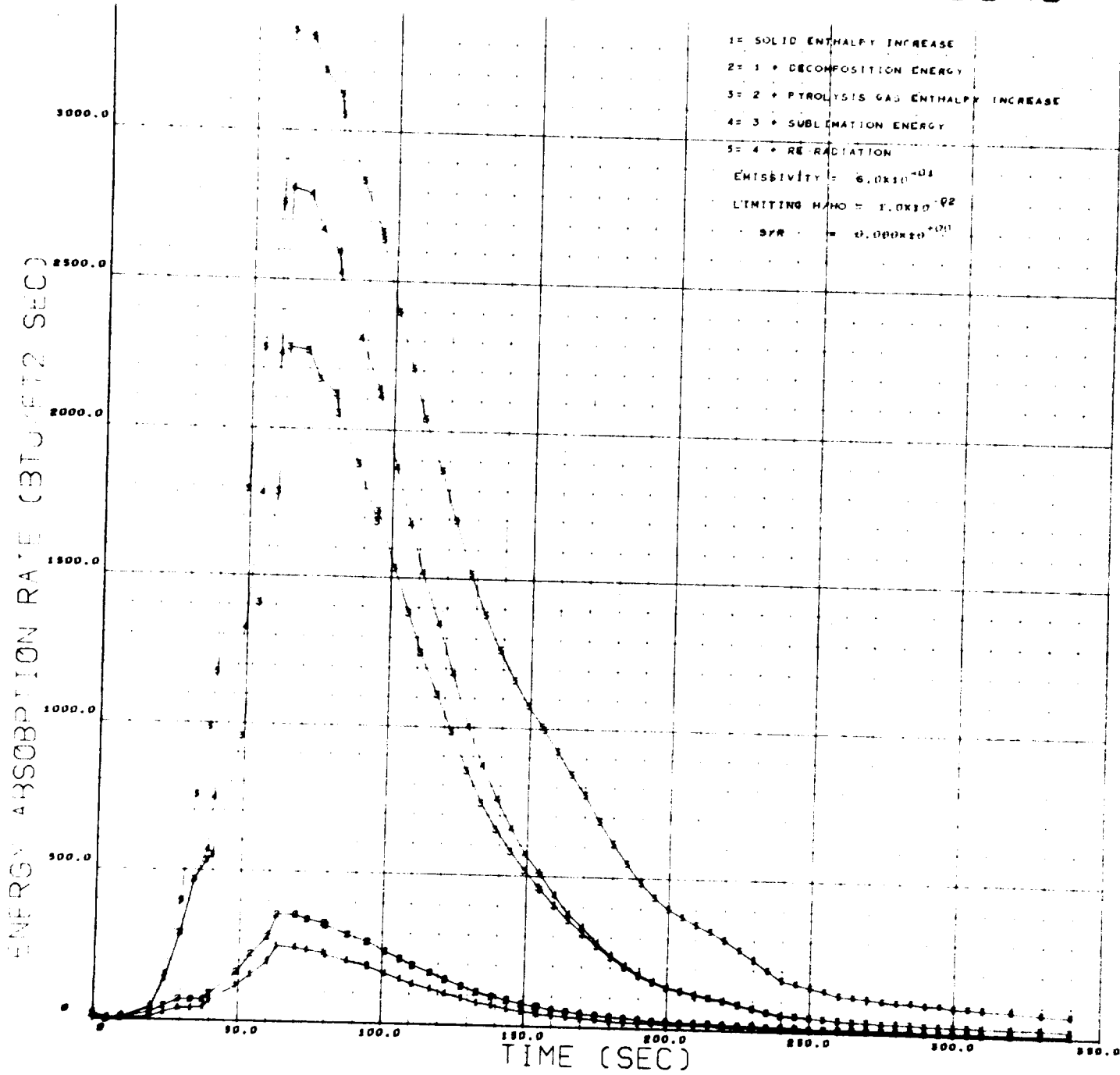


FIGURE A 82

HEATING RATE HISTORY

APOLLO 17X UB

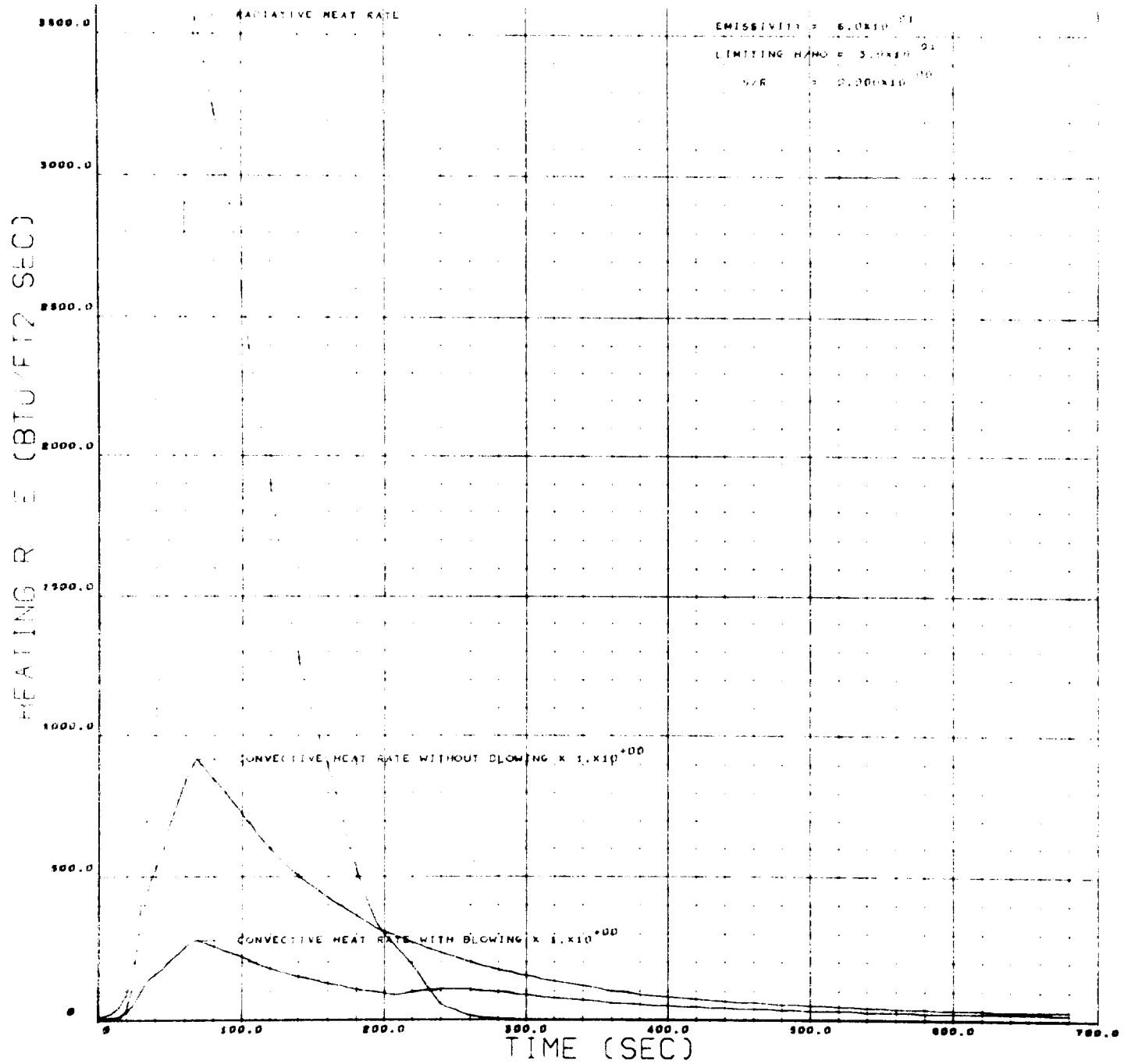


FIGURE A 82

MATERIAL RESPONSE DATA

APOLLO 37K 08

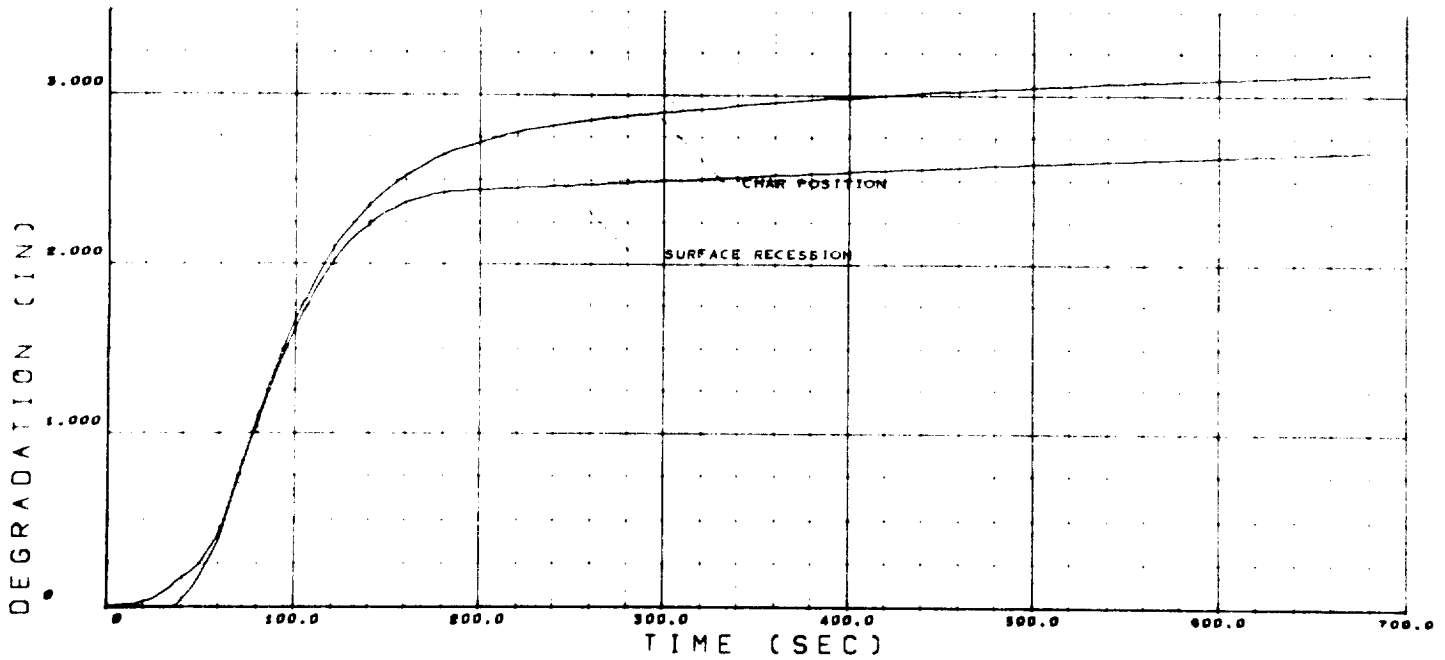
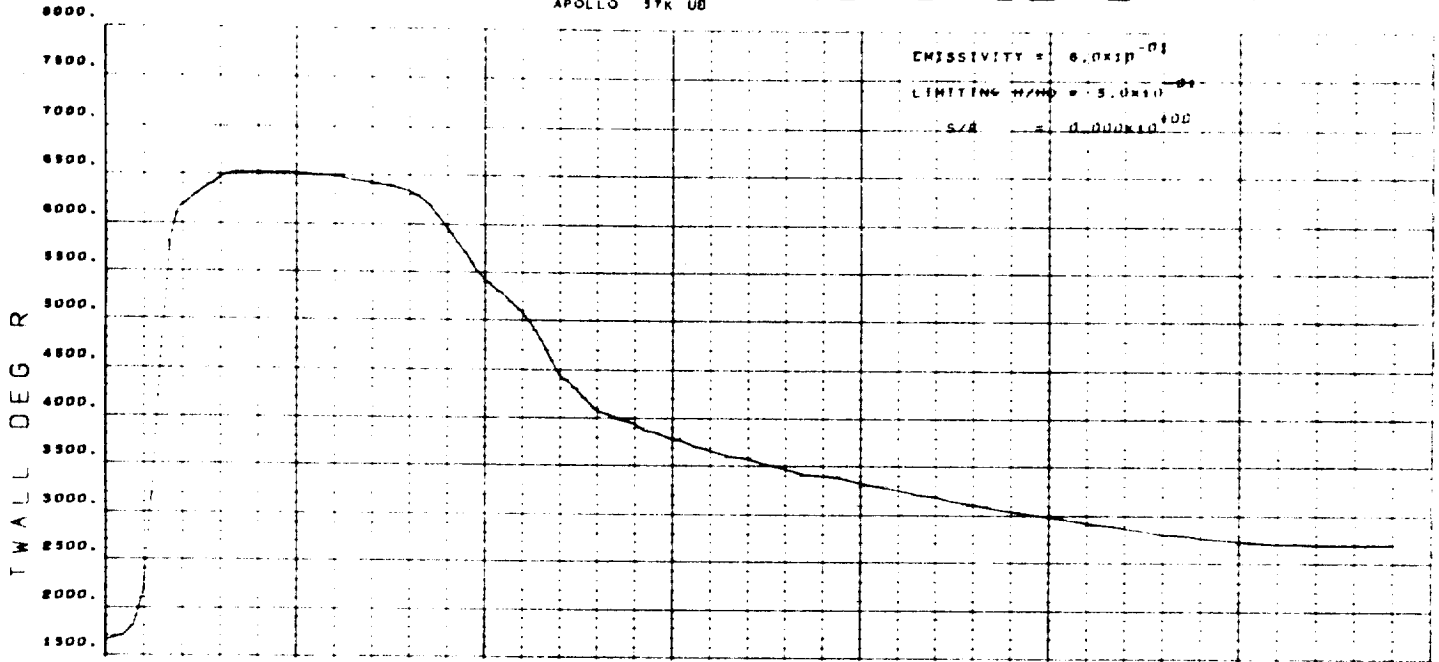


FIGURE A 82

ENERGY ACCOMMODATION MECHANISMS

APOLLO 17K UB

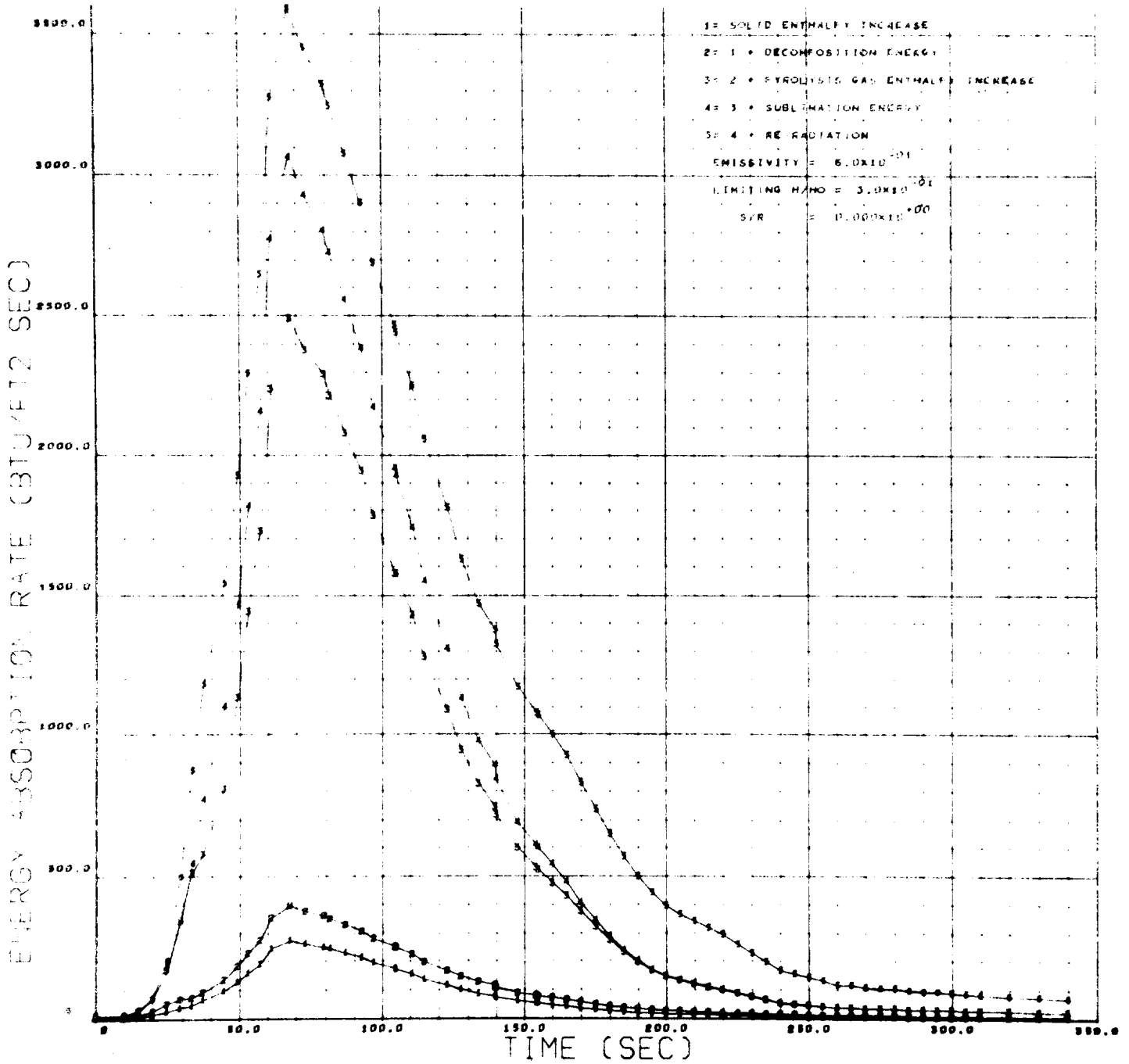


FIGURE A 83

HEATING RATE HISTORY

APOLLO 37K UB

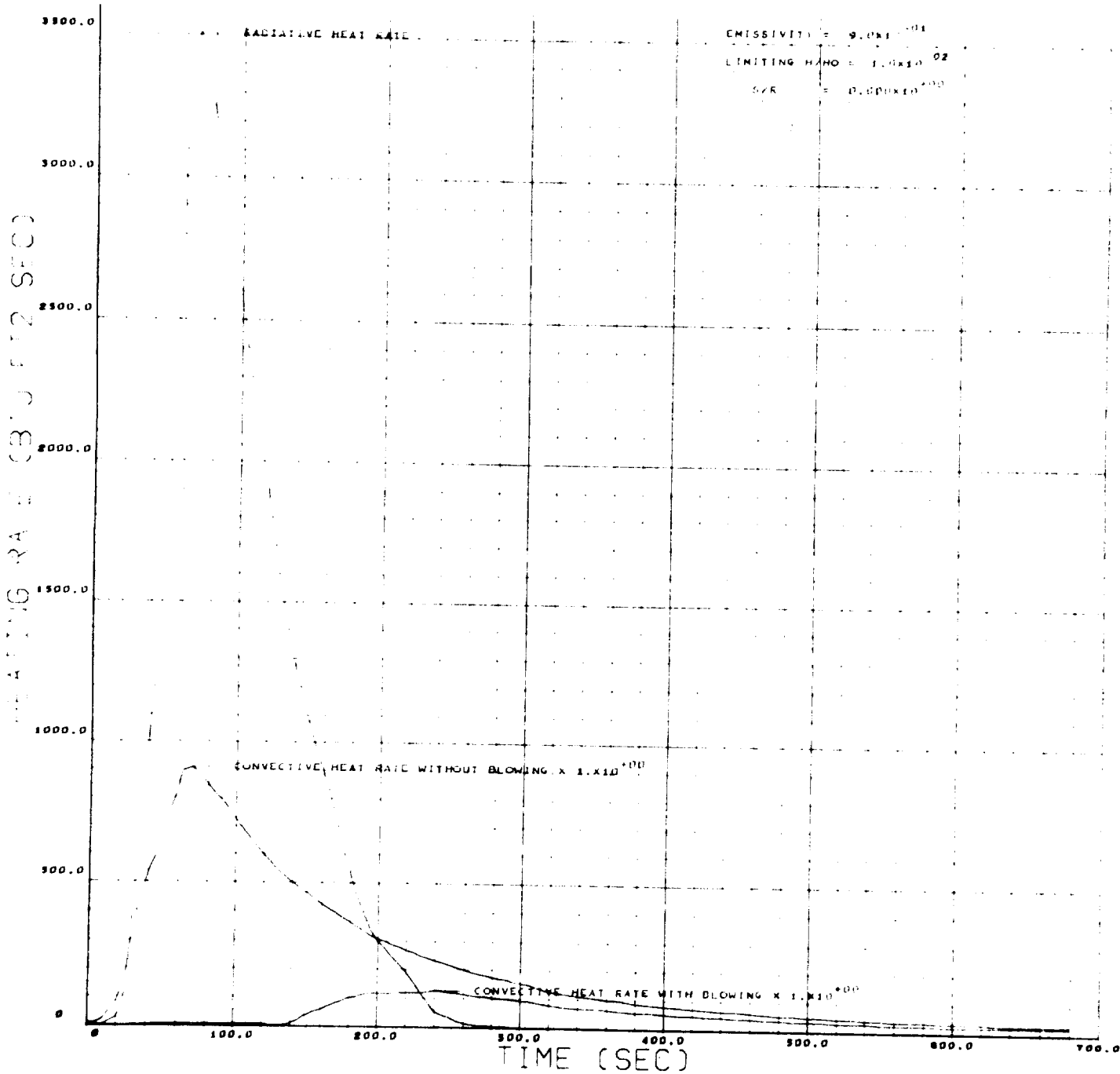


FIGURE A 23

MATERIAL RESPONSE DATA

APOLLO 37A UB

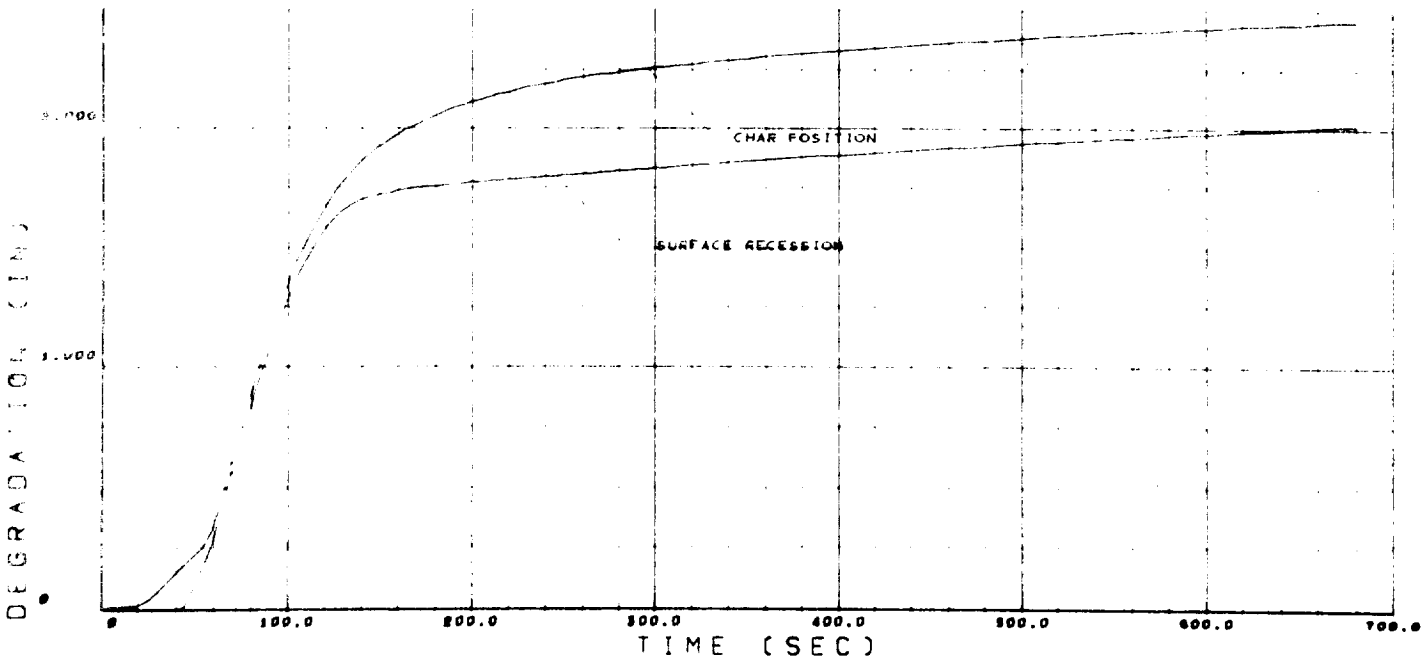
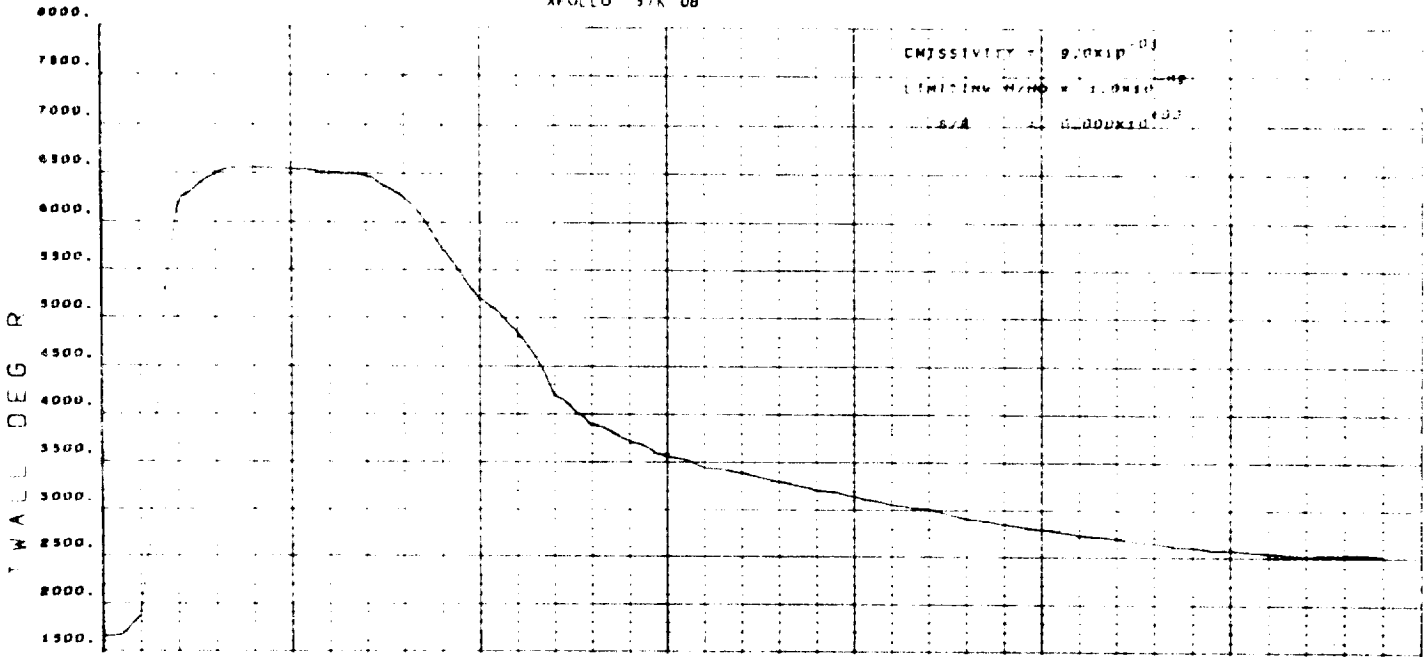


FIGURE A 83

ENERGY ACCOMMODATION MECHANISMS

APOLLO 17K UD

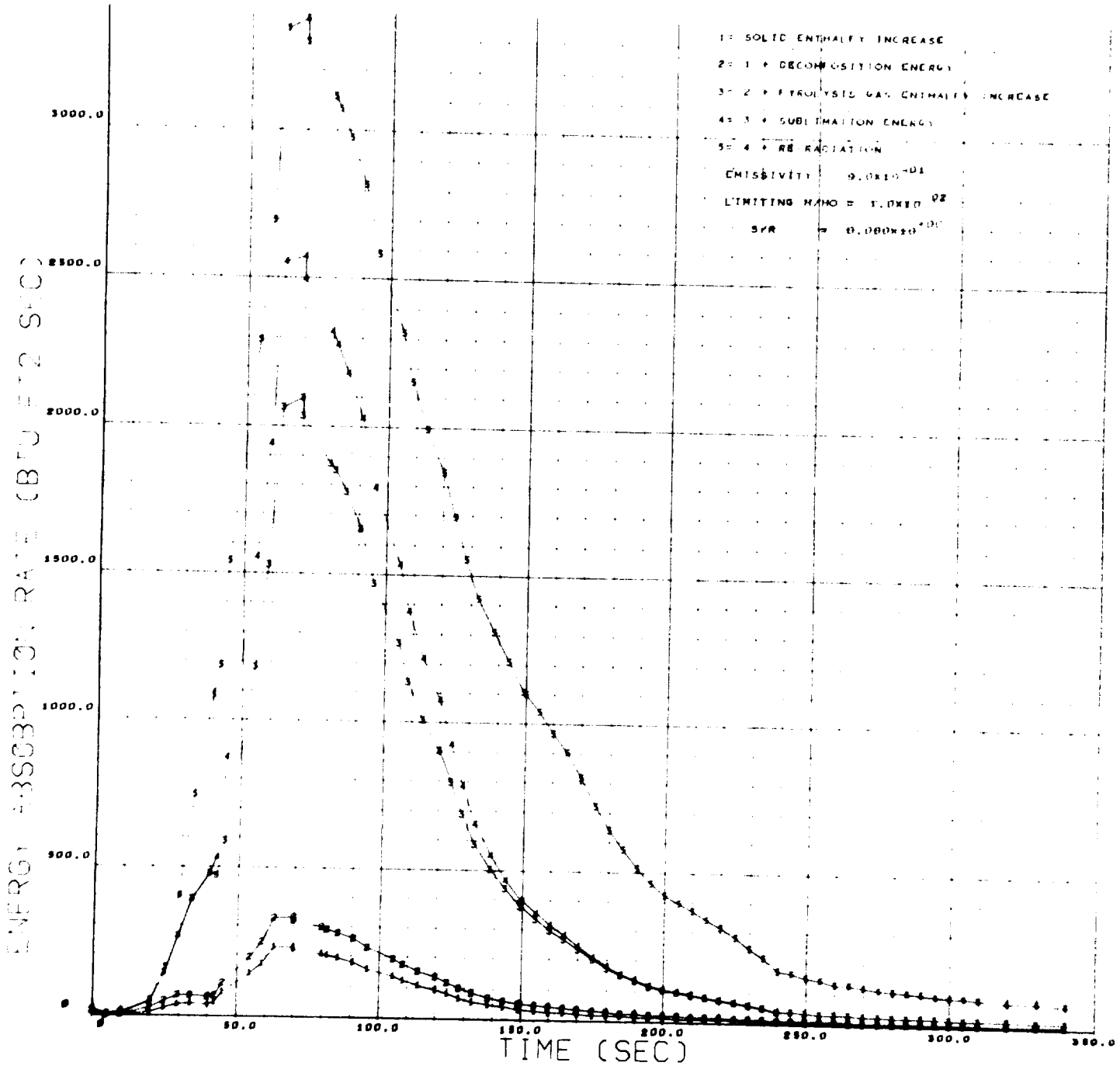


FIGURE A 84

HEATING RATE HISTORY

APOLLO 37K UB

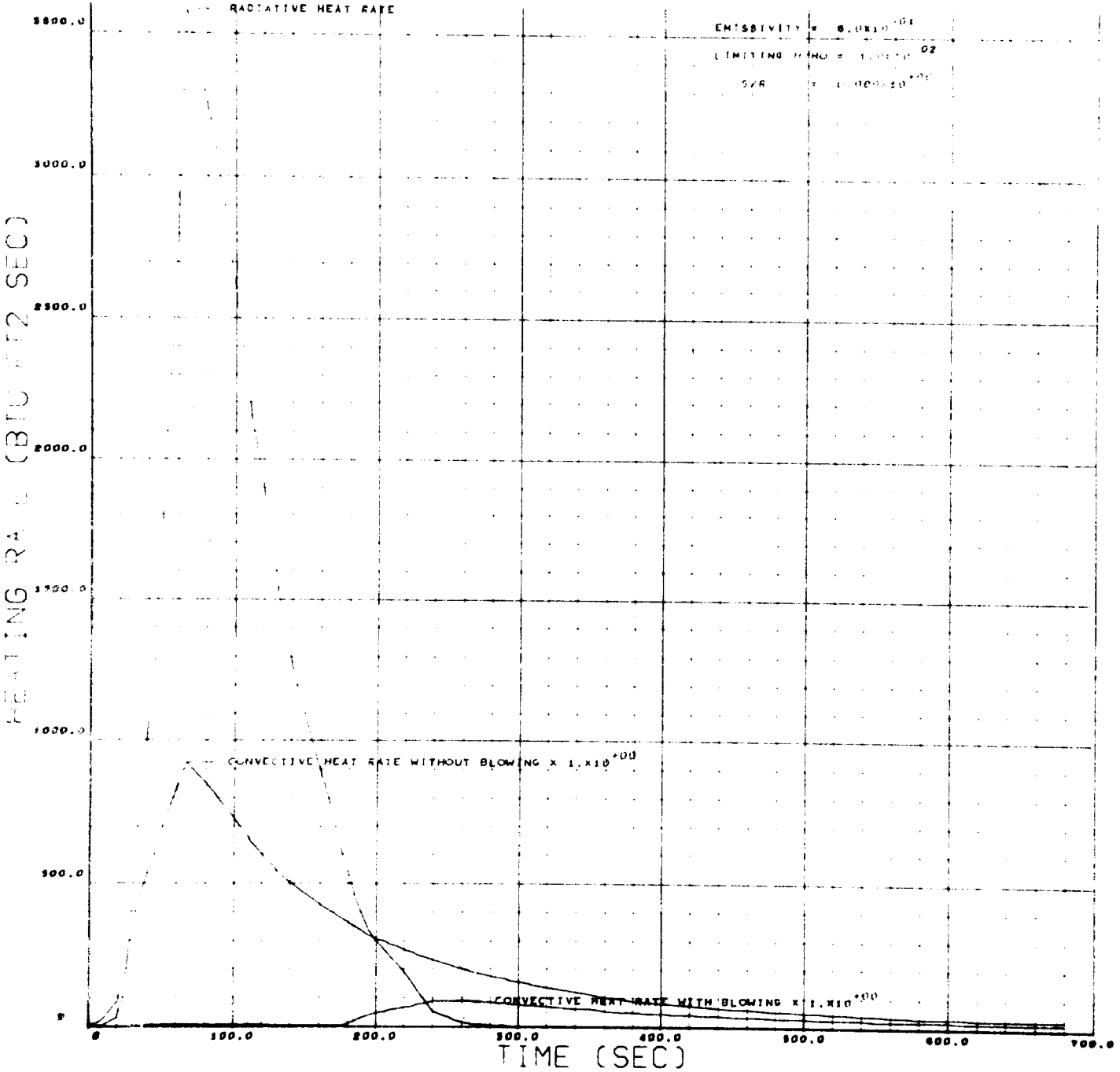


FIGURE A 84

MATERIAL RESPONSE DATA

APOLLO 57K UB

EMISSIVITY = 0.0X10⁻⁰¹
 LIMITING W/MO = 1.0X10⁻⁰⁰
 S/A = 0.000X10⁰⁰

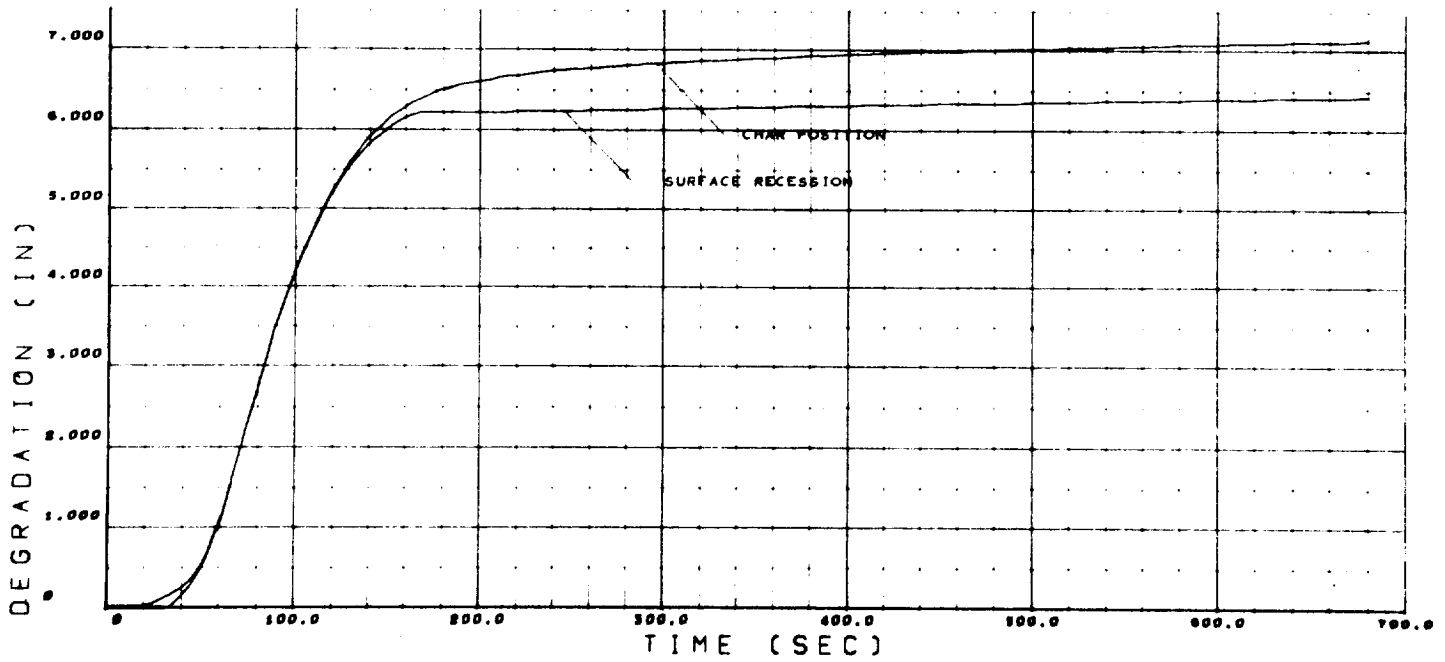
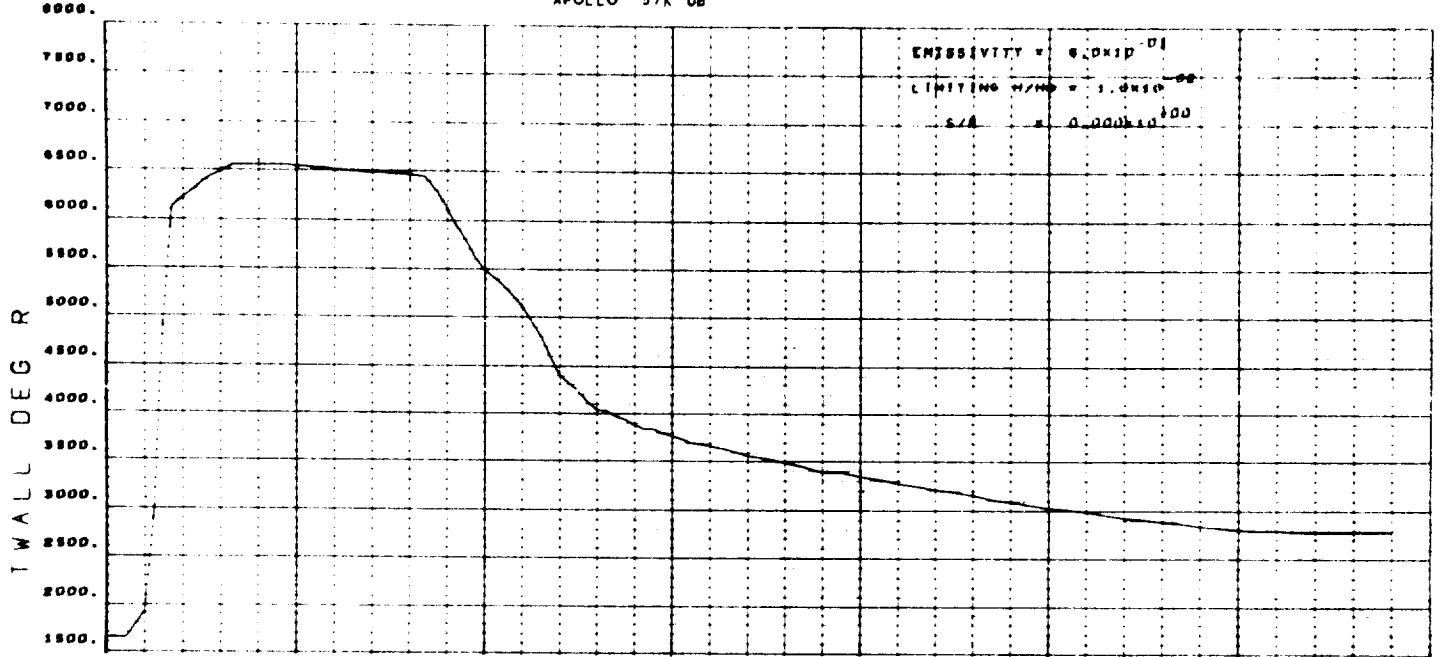


FIGURE A 84

ENERGY ACCOMMODATION MECHANISMS

APOLLO 17K UB

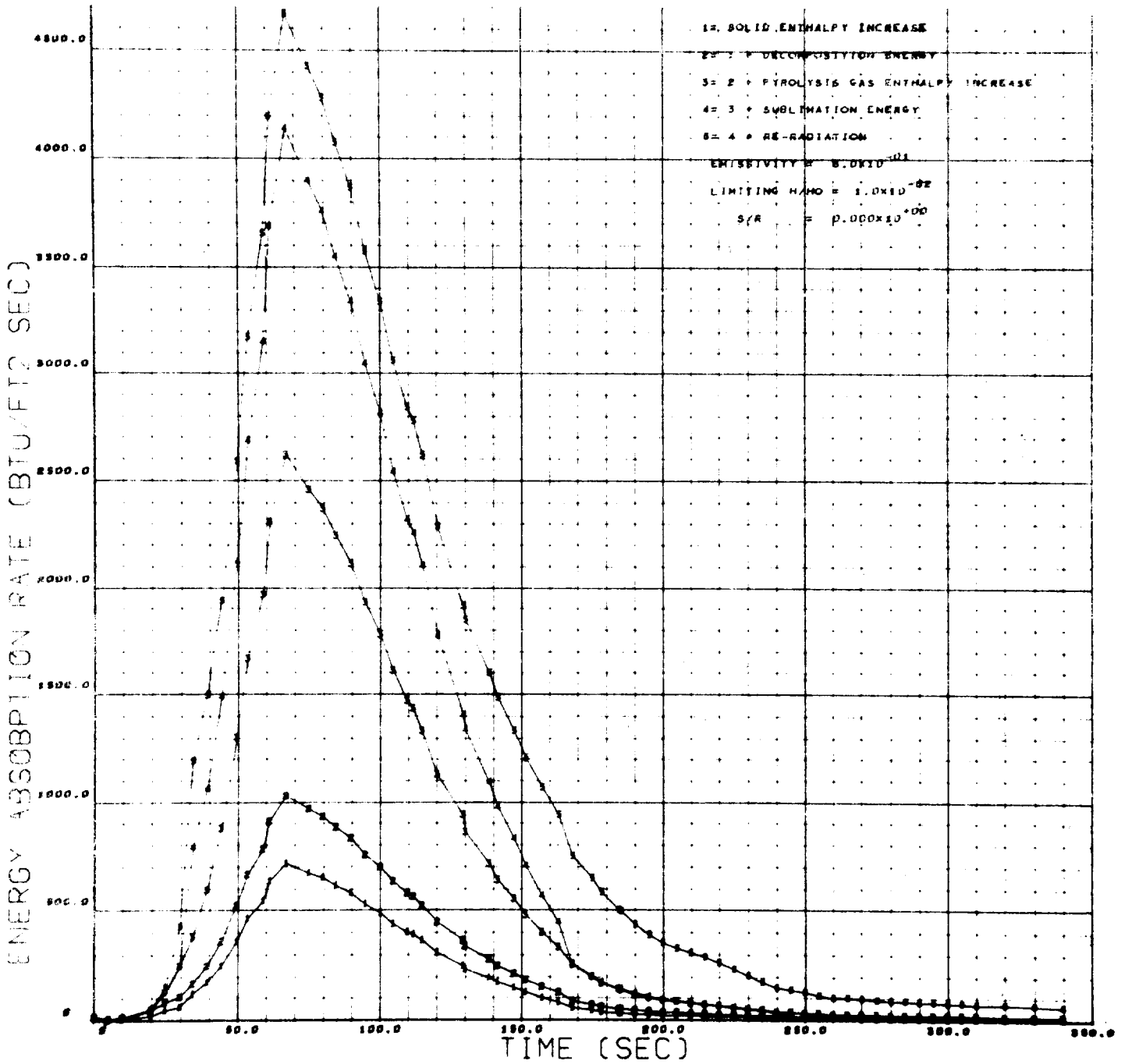


FIGURE A 85

HEATING RATE HISTORY

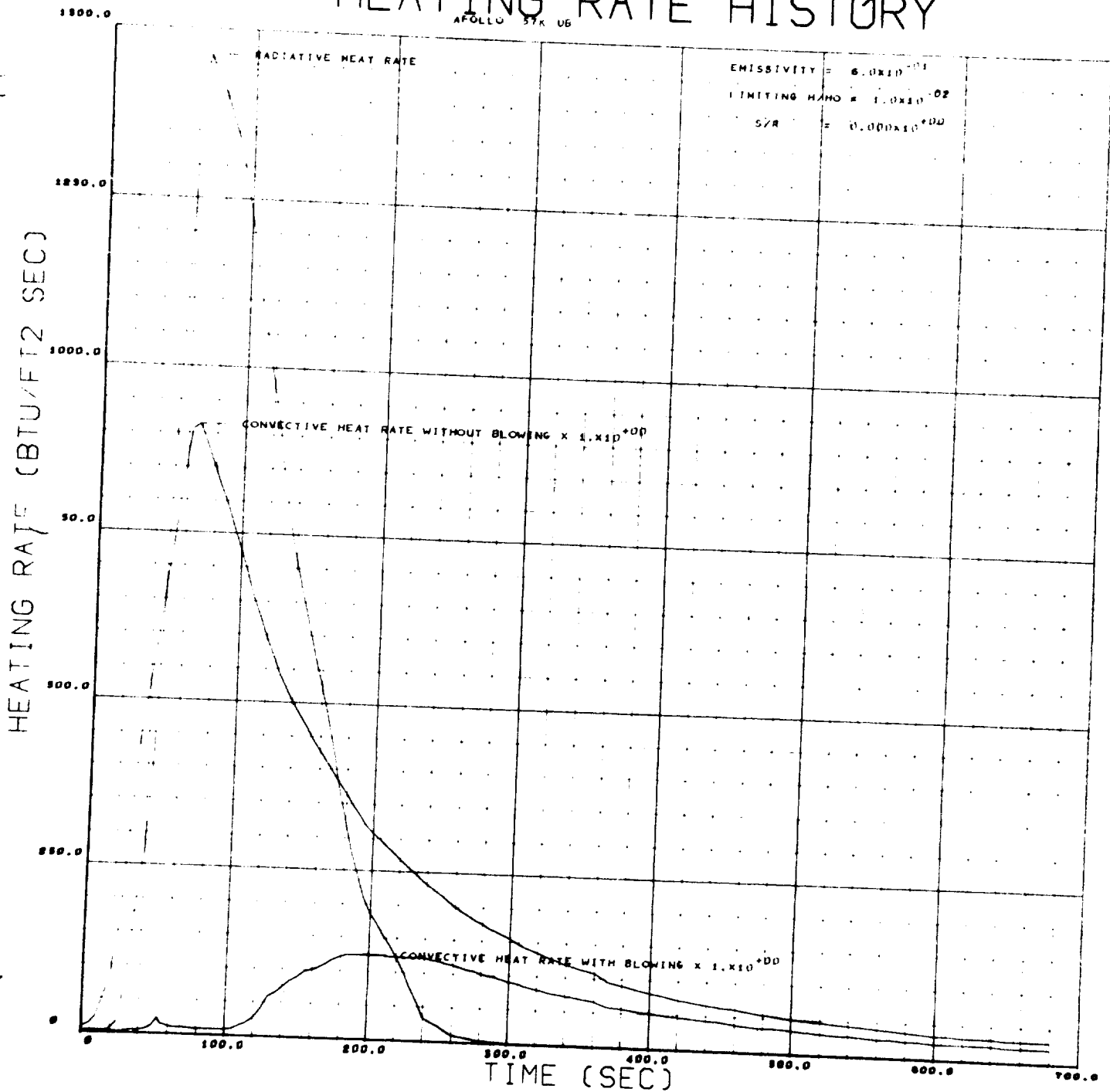
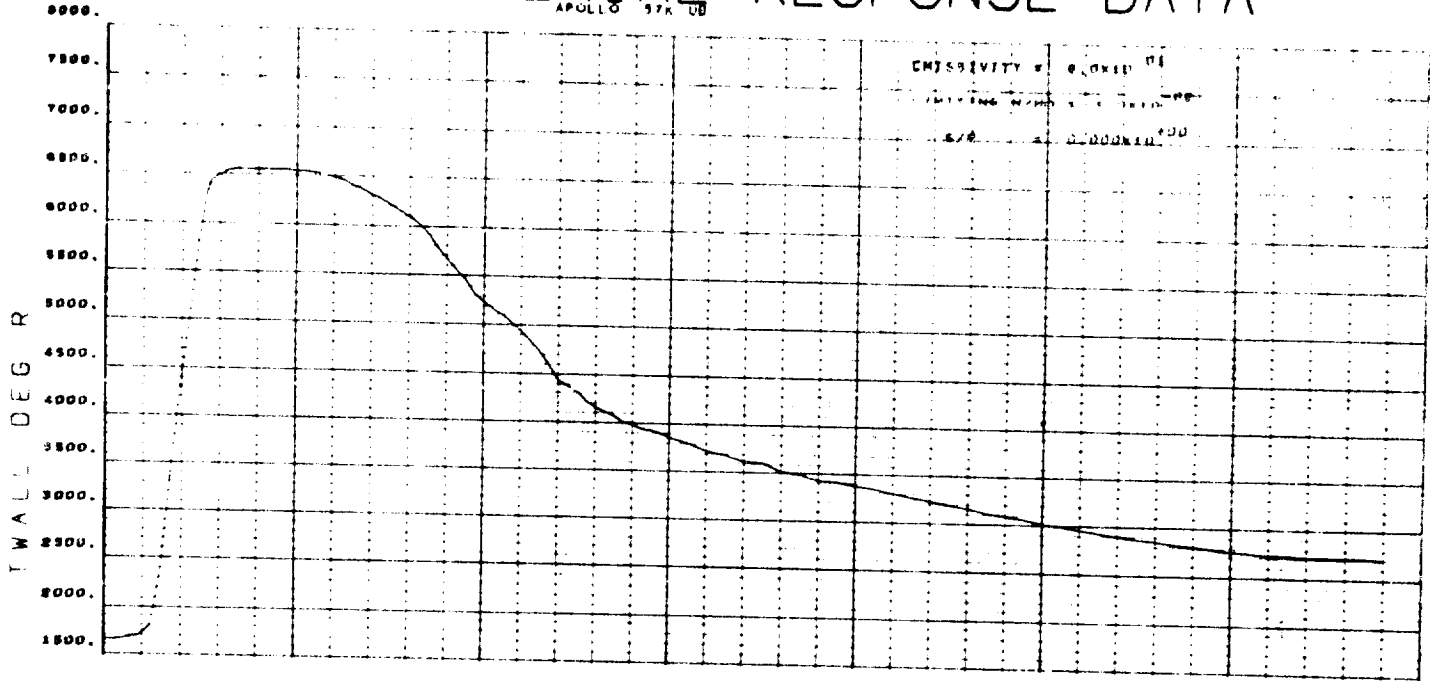


FIGURE A 85

MATERIAL RESPONSE DATA

APOLLO 57K UB



CREISSIVITY # 0.0010 01
 TIME (SEC) 0.00 100.00
 200.00 300.00 400.00 500.00 600.00 700.00

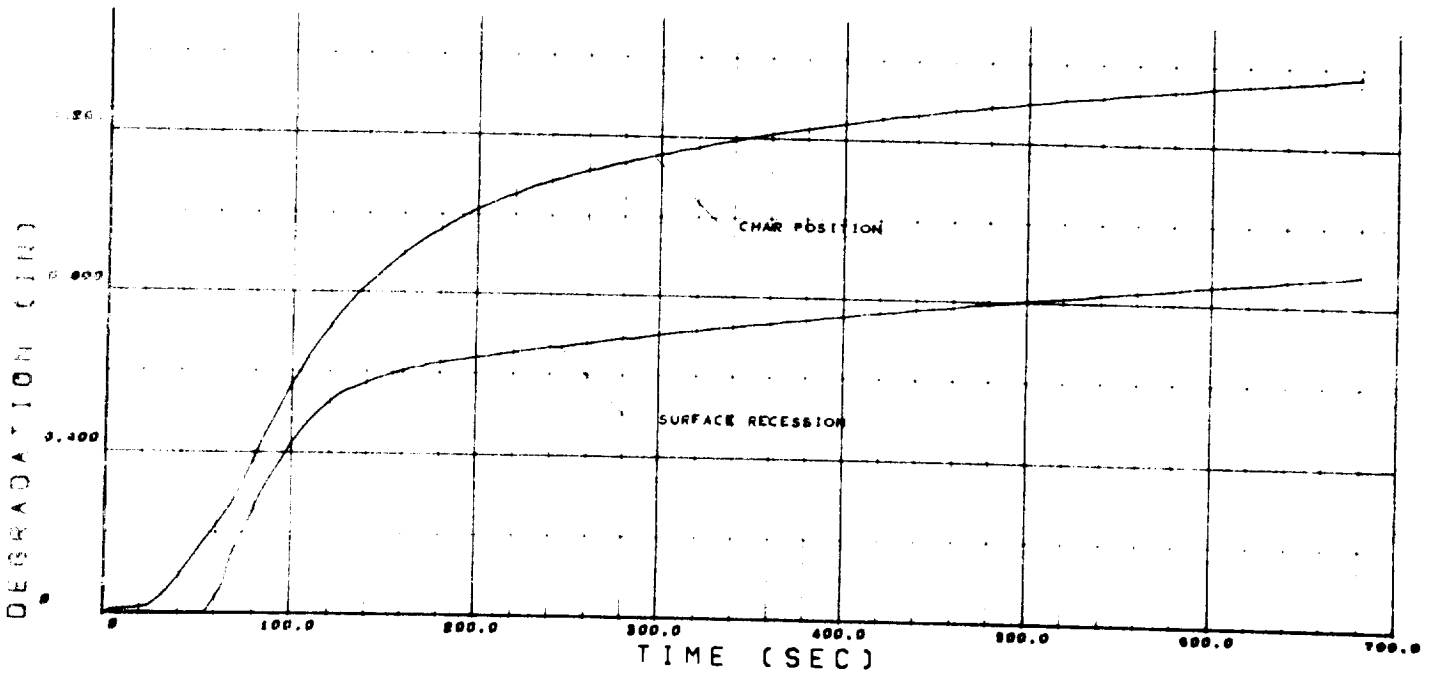


FIGURE A85

ENERGY ACCOMMODATION MECHANISMS

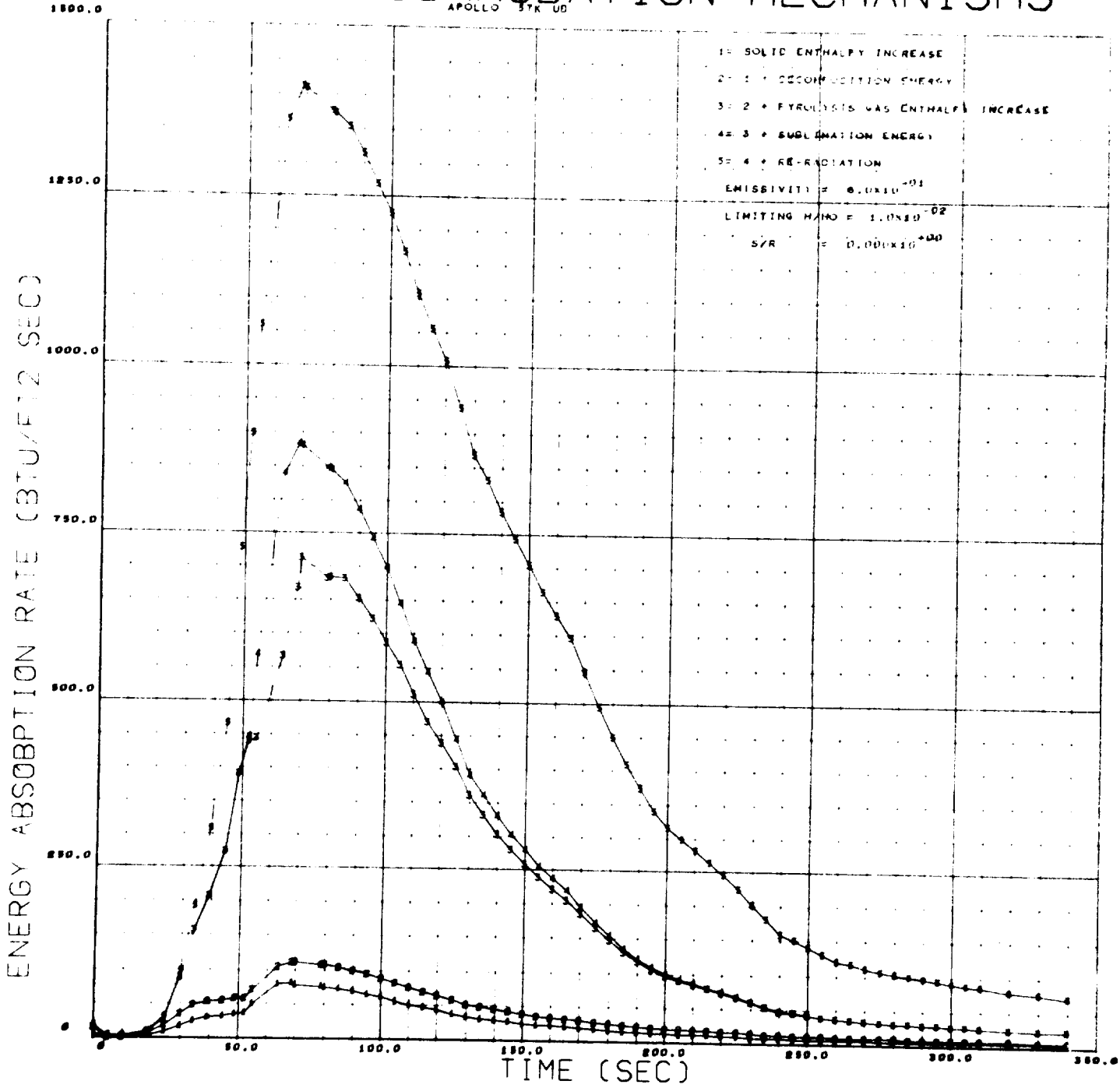


FIGURE A 86

HEATING RATE HISTORY

APOLLO 37K US

EMISSIVITY = 0.0810⁻⁰¹
LIMITING HANG = 1.0000⁻⁰²
SYN = 0.00000⁺⁰⁰

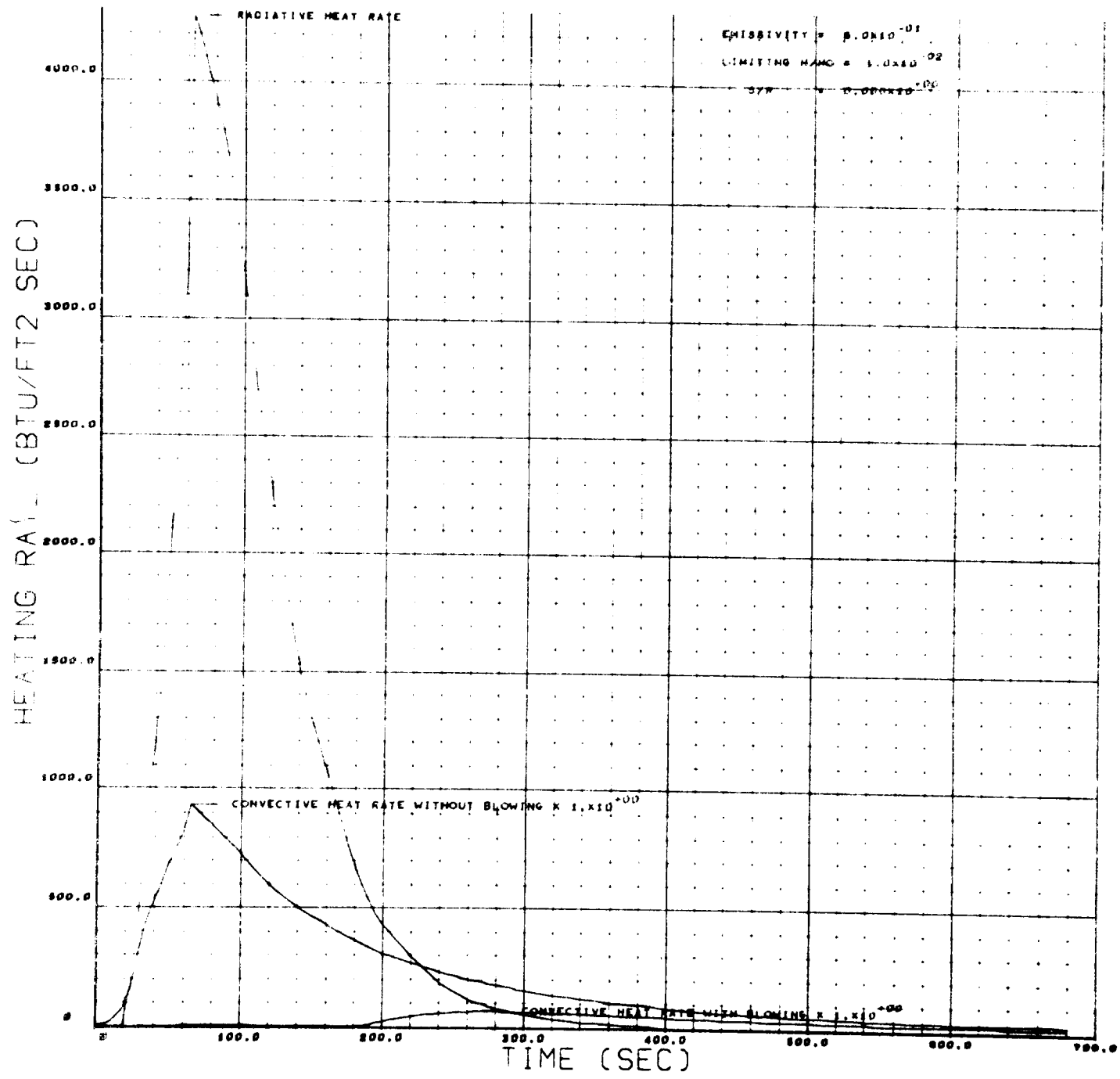


FIGURE A86

MATERIAL RESPONSE DATA

APOLLO 57K UB

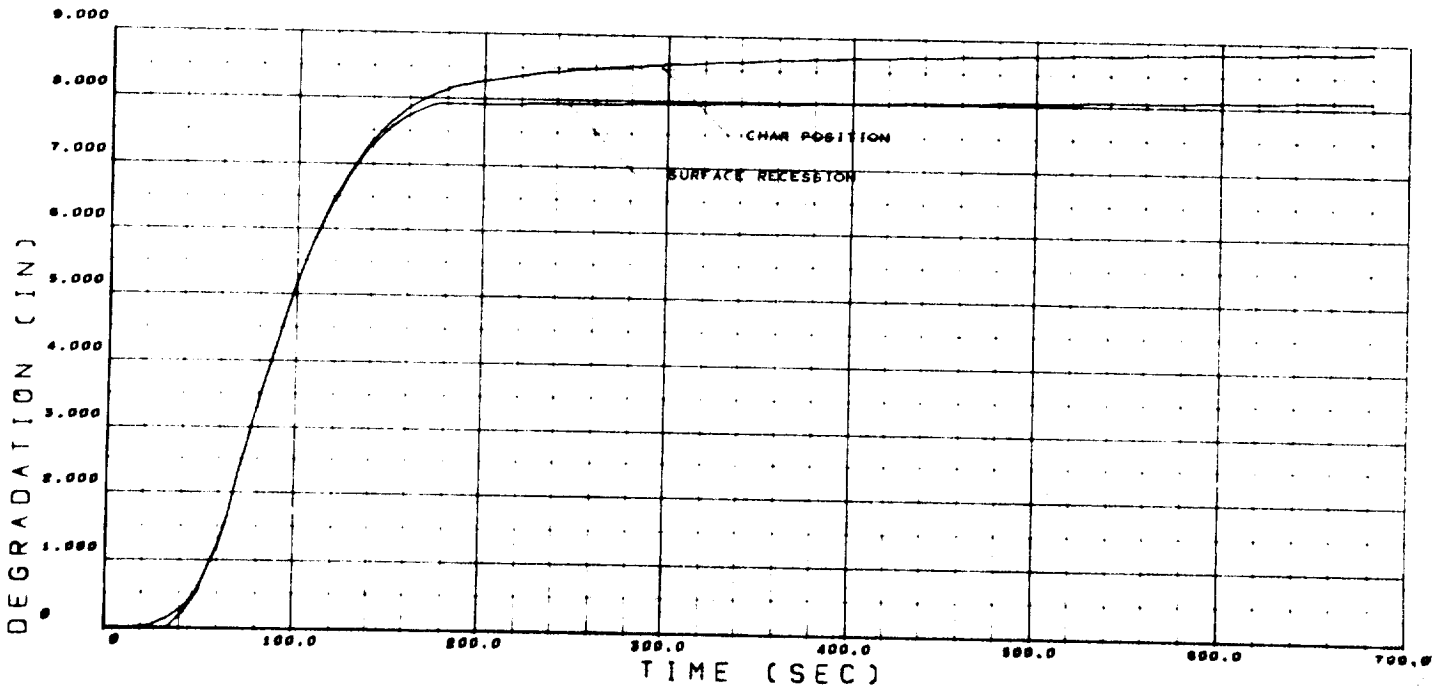
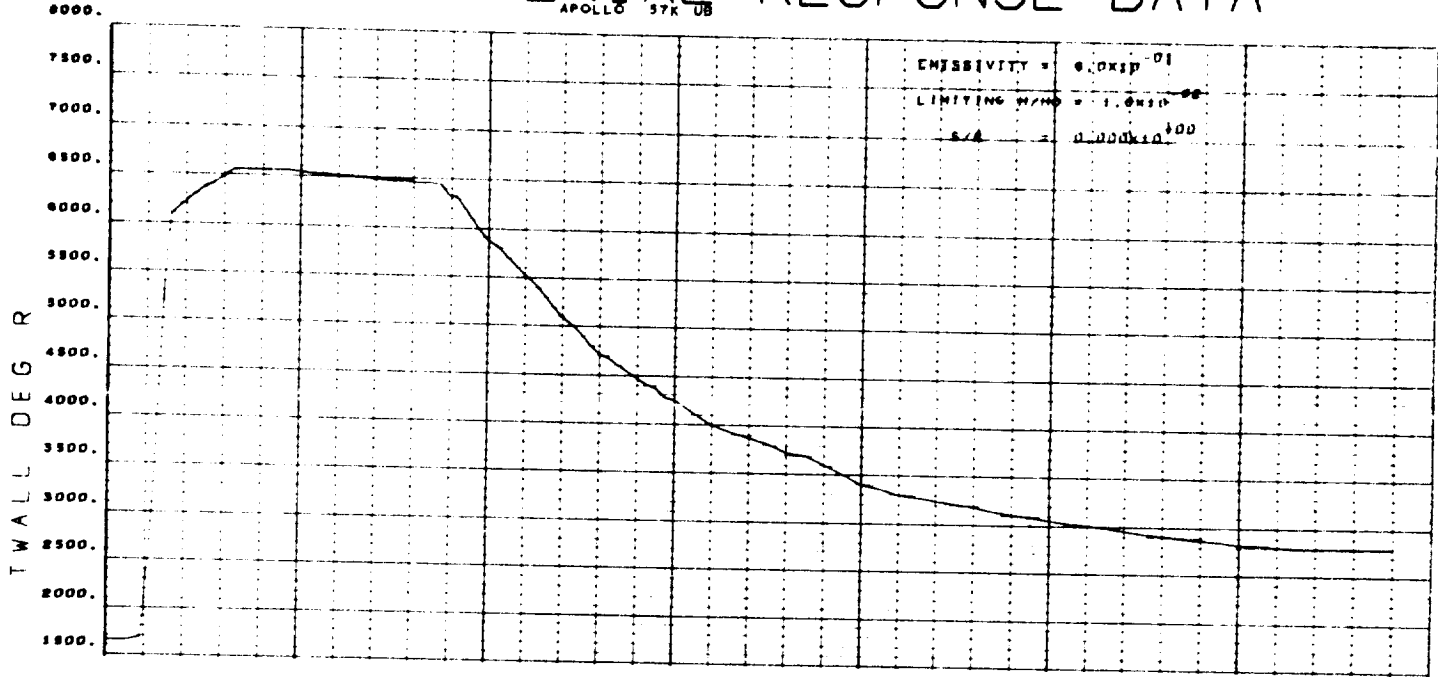


FIGURE A86

ENERGY ACCOMMODATION MECHANISMS

APOLLO 57K UB

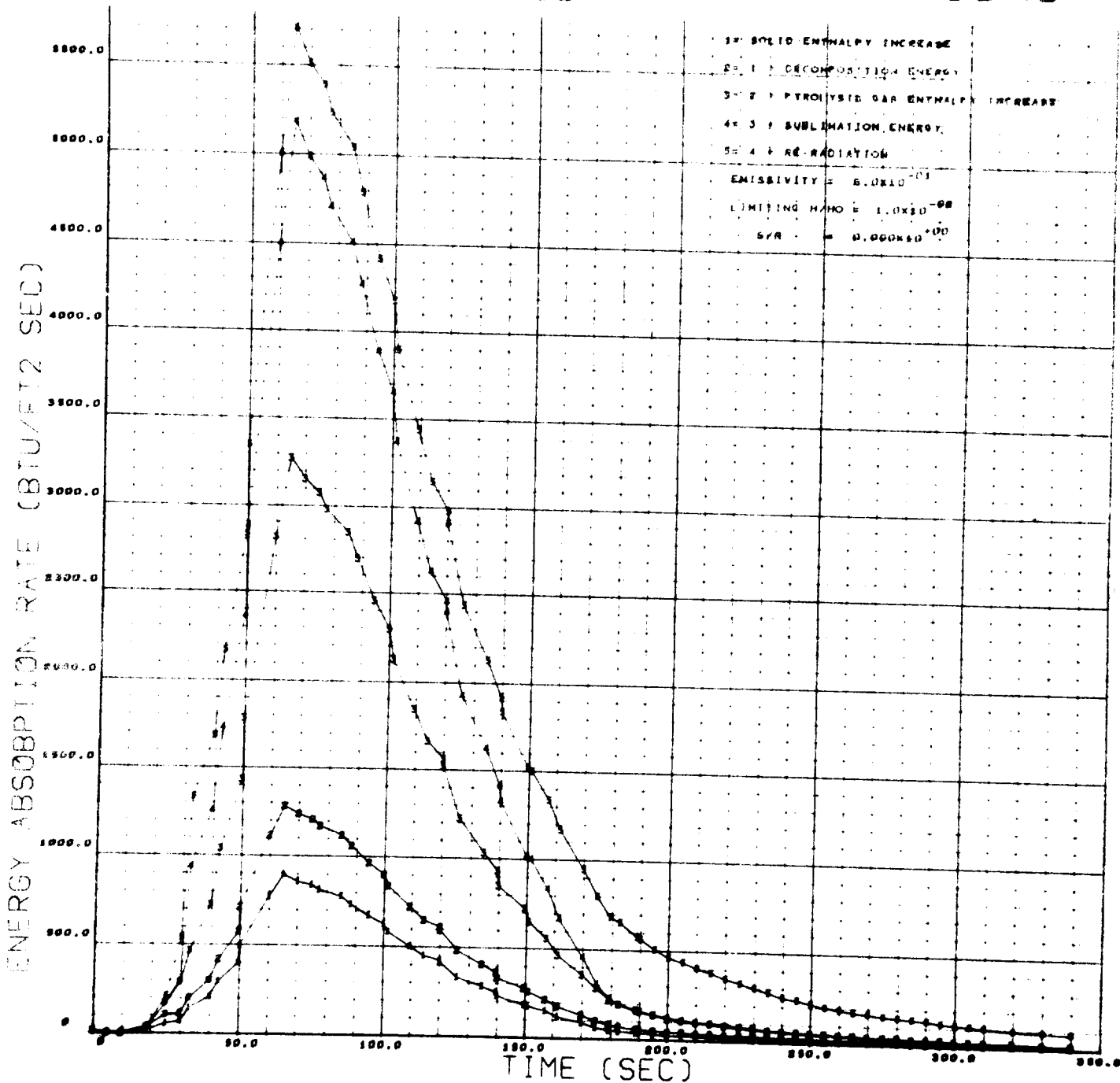


FIGURE A 87

HEATING RATE HISTORY

APOLLO 37K US

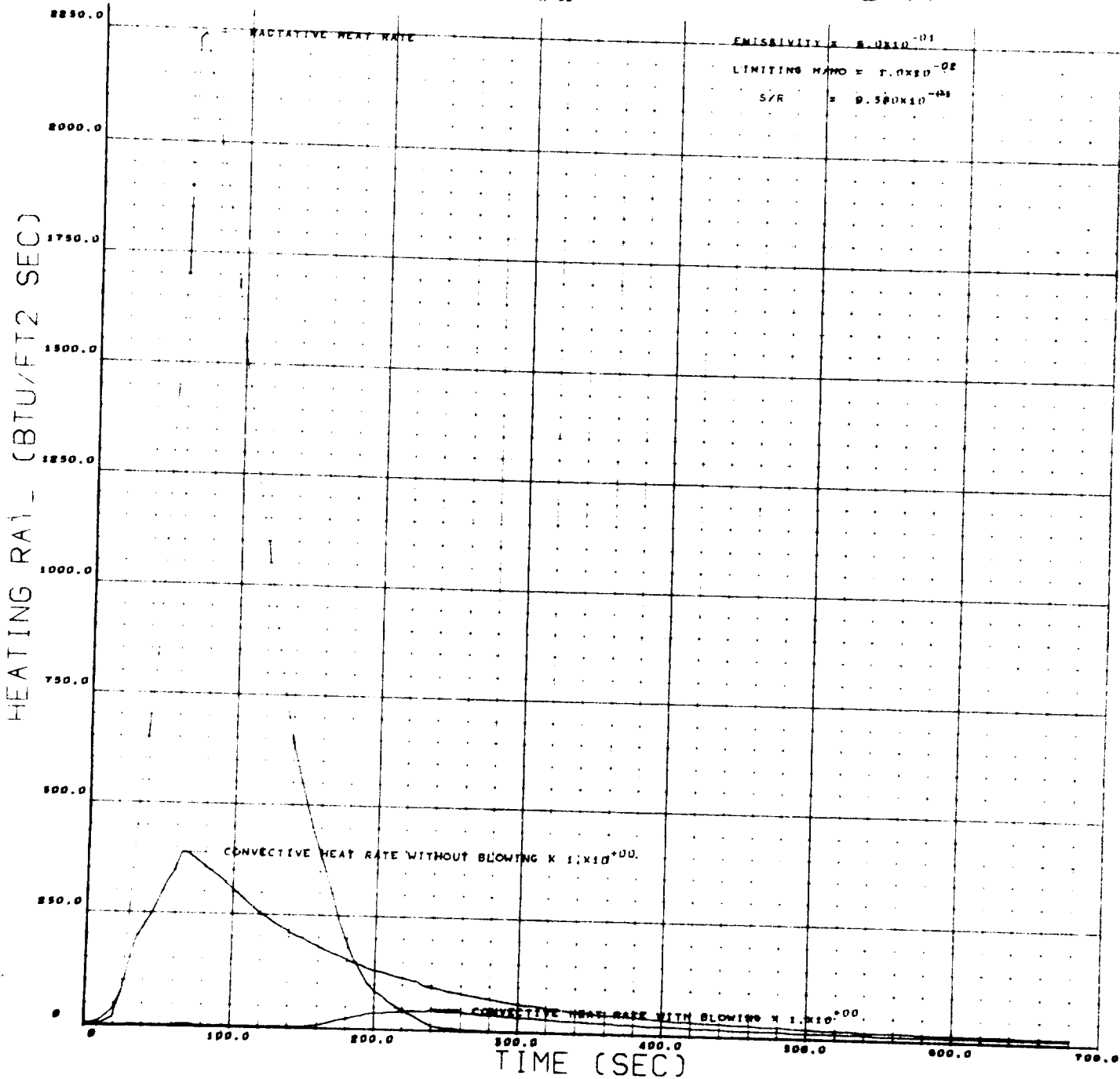


FIGURE A 87

MATERIAL RESPONSE DATA

APOLLO 37K UB

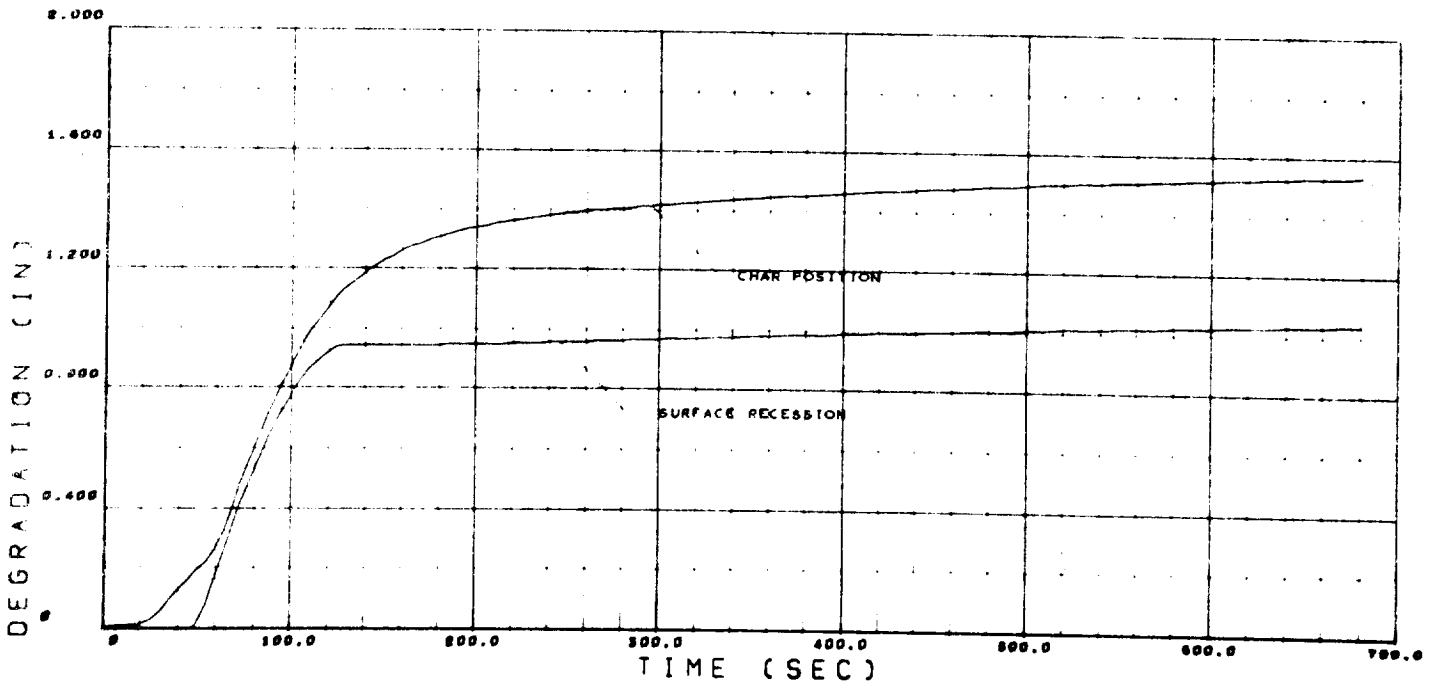
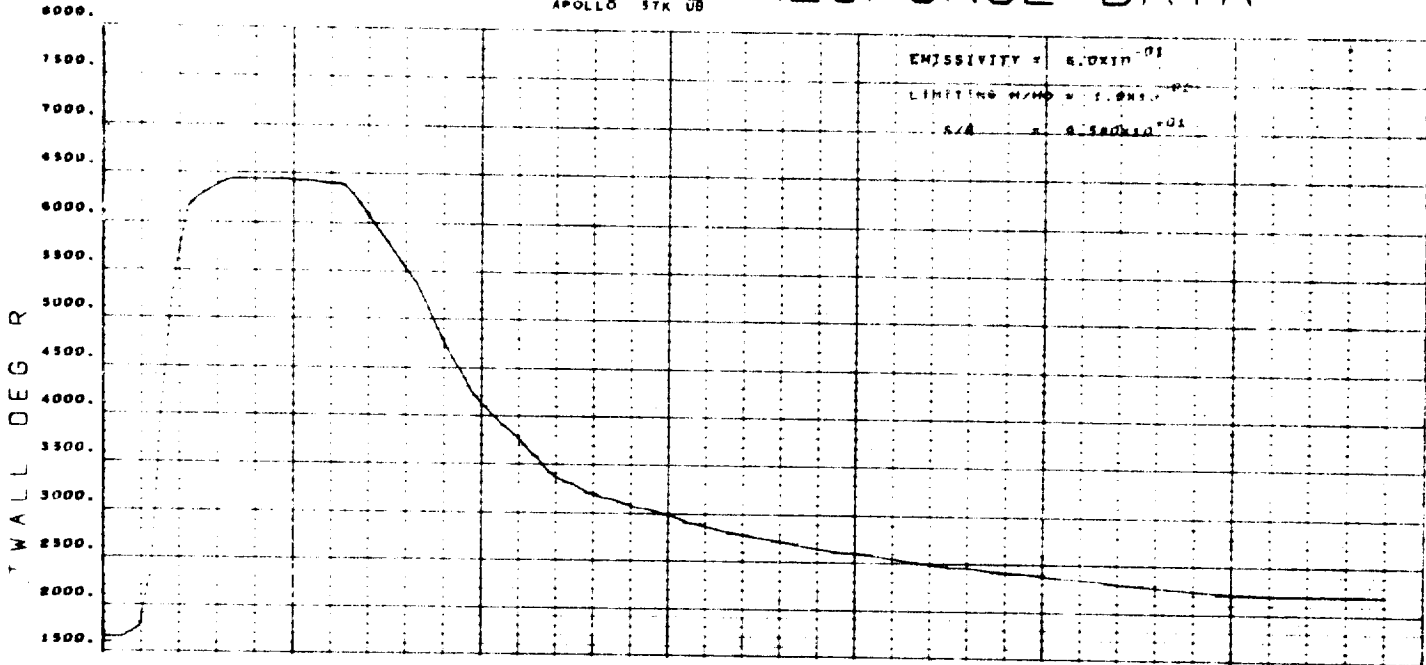


FIGURE A87

ENERGY ACCOMMODATION MECHANISMS

APOLLO 37K UB

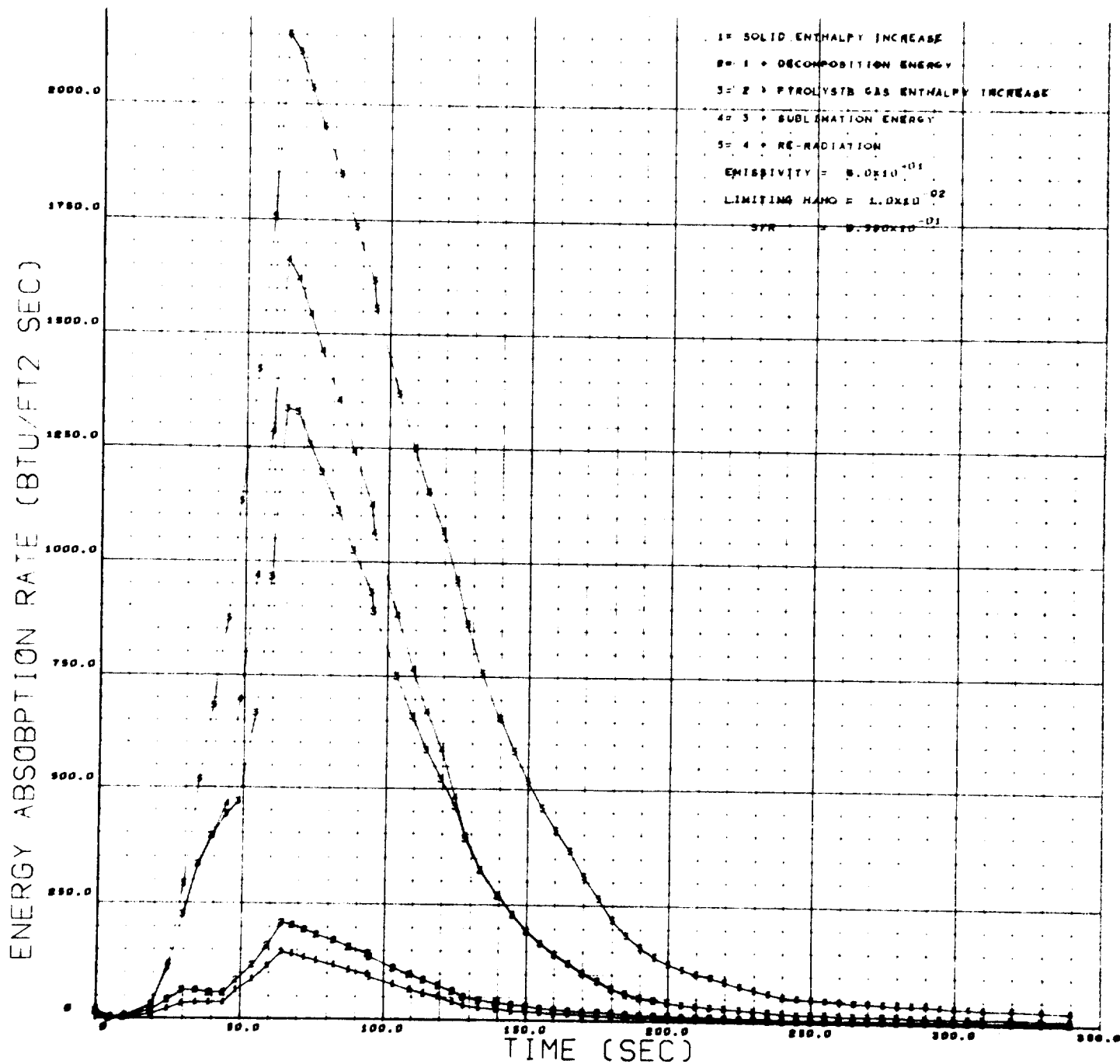


FIGURE A 88

HEATING RATE HISTORY

APOLLO 57K UB

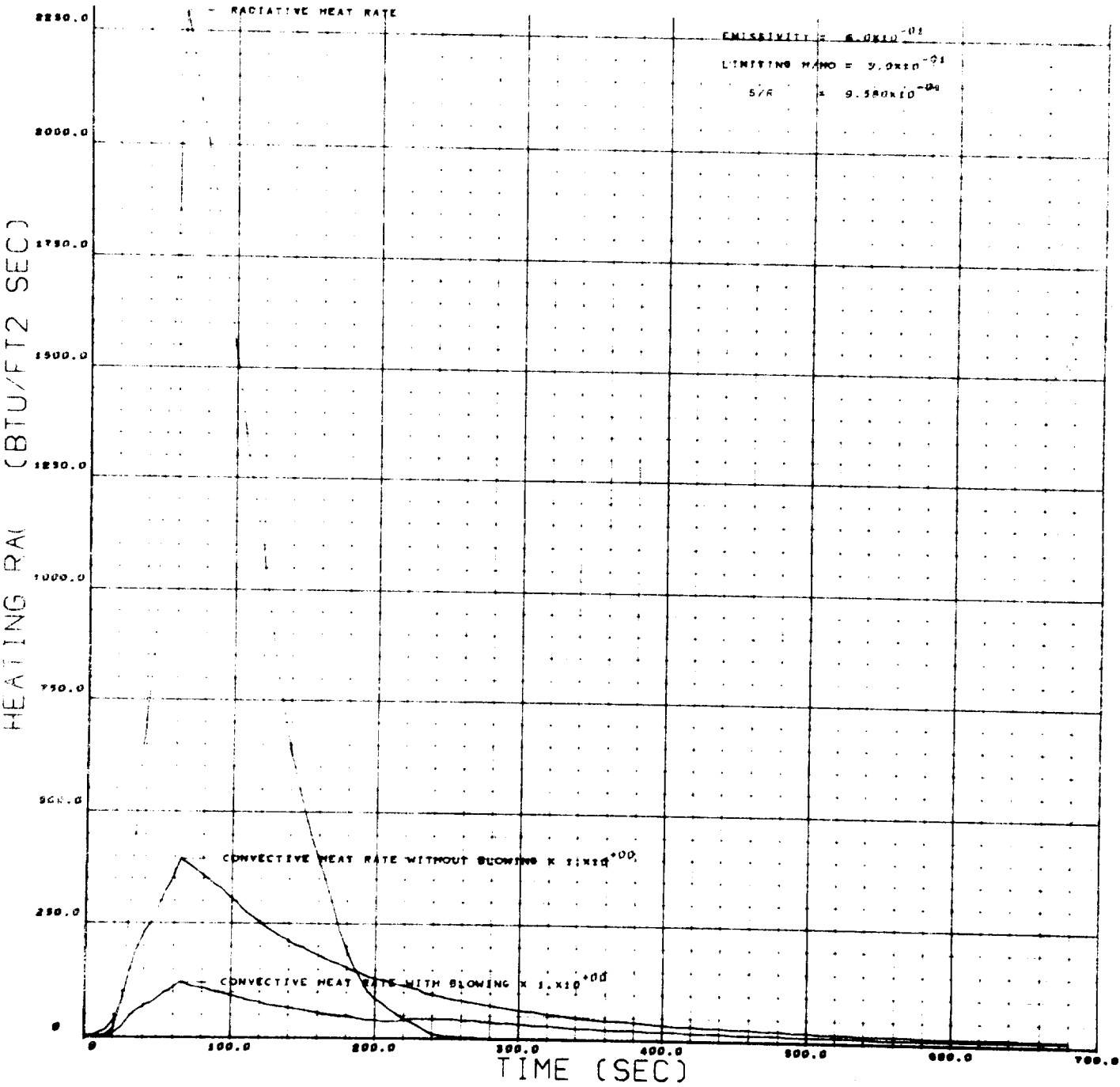


FIGURE A88

MATERIAL RESPONSE DATA

APOLLO 57K UB

EMISSIVITY = 6.0×10^{-01}
LIMITING H/MO = 3.0×10^{-01}
S/A = 0.500×10^{-01}

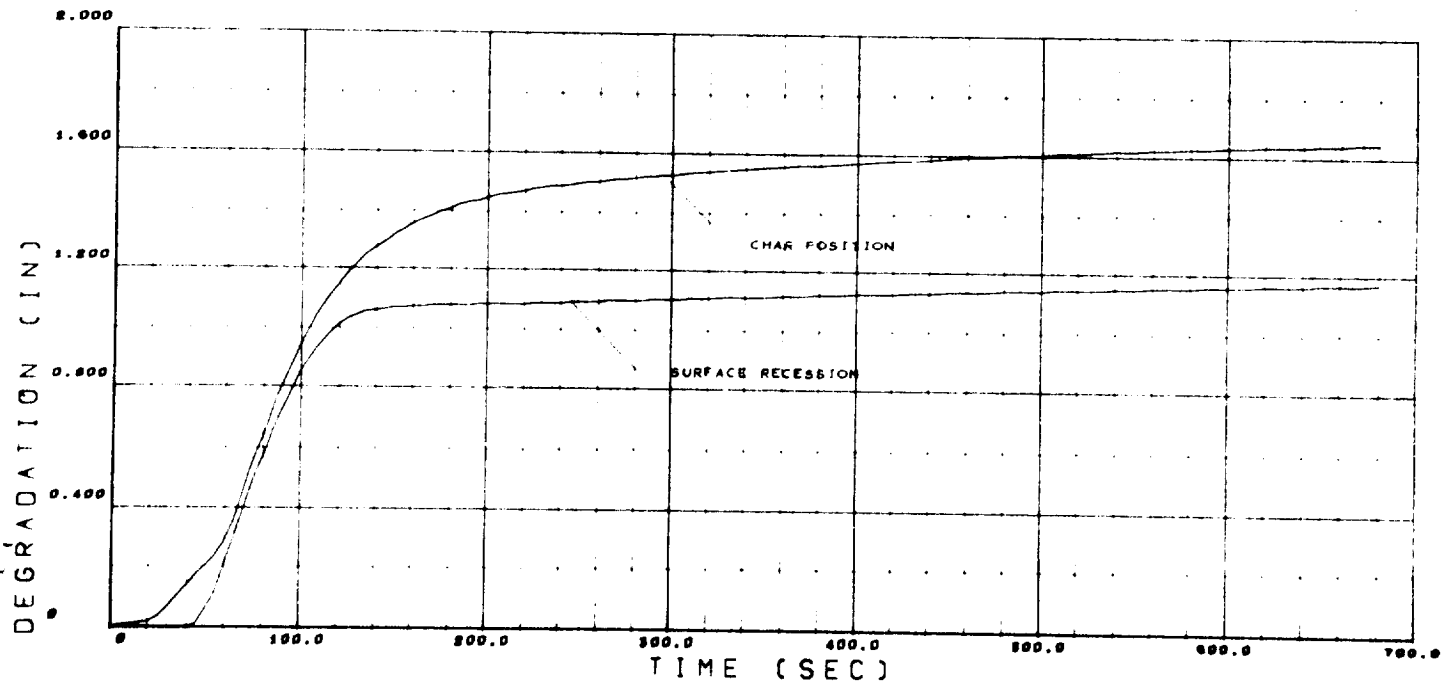
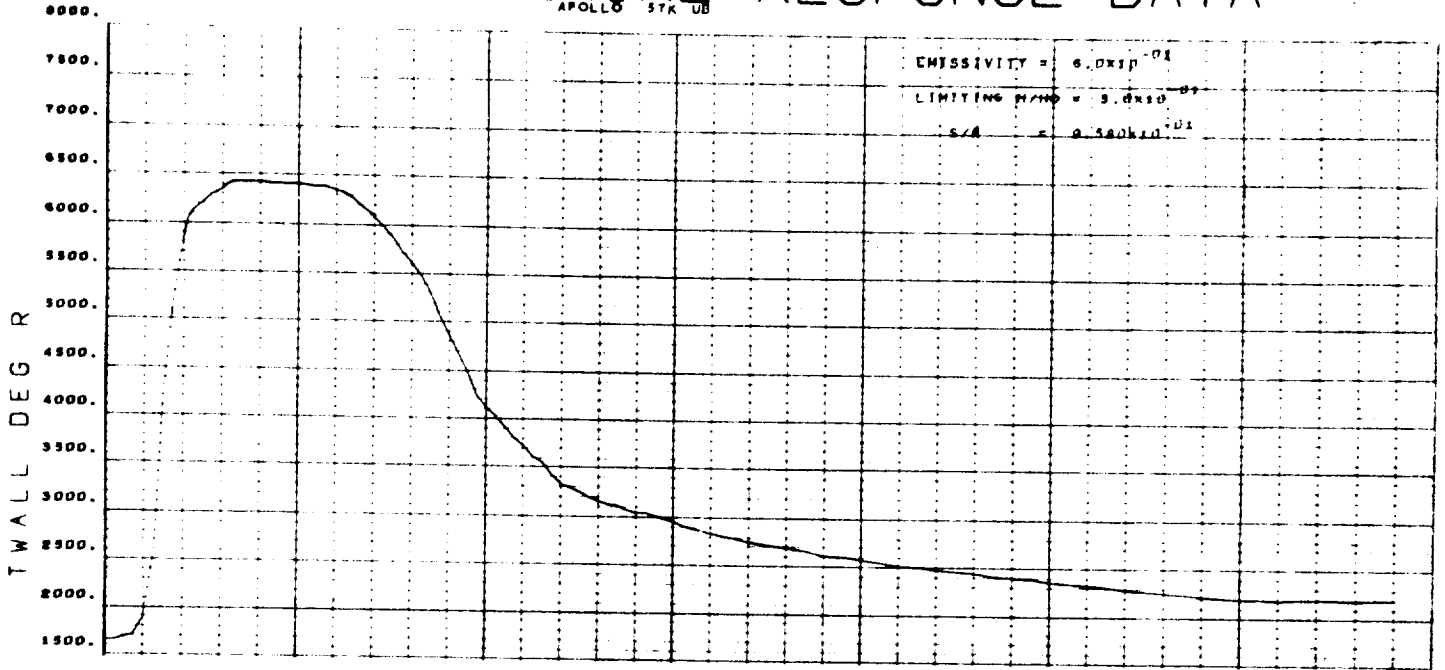


FIGURE A88

ENERGY ACCOMMODATION MECHANISMS

APOLLO 57K UB

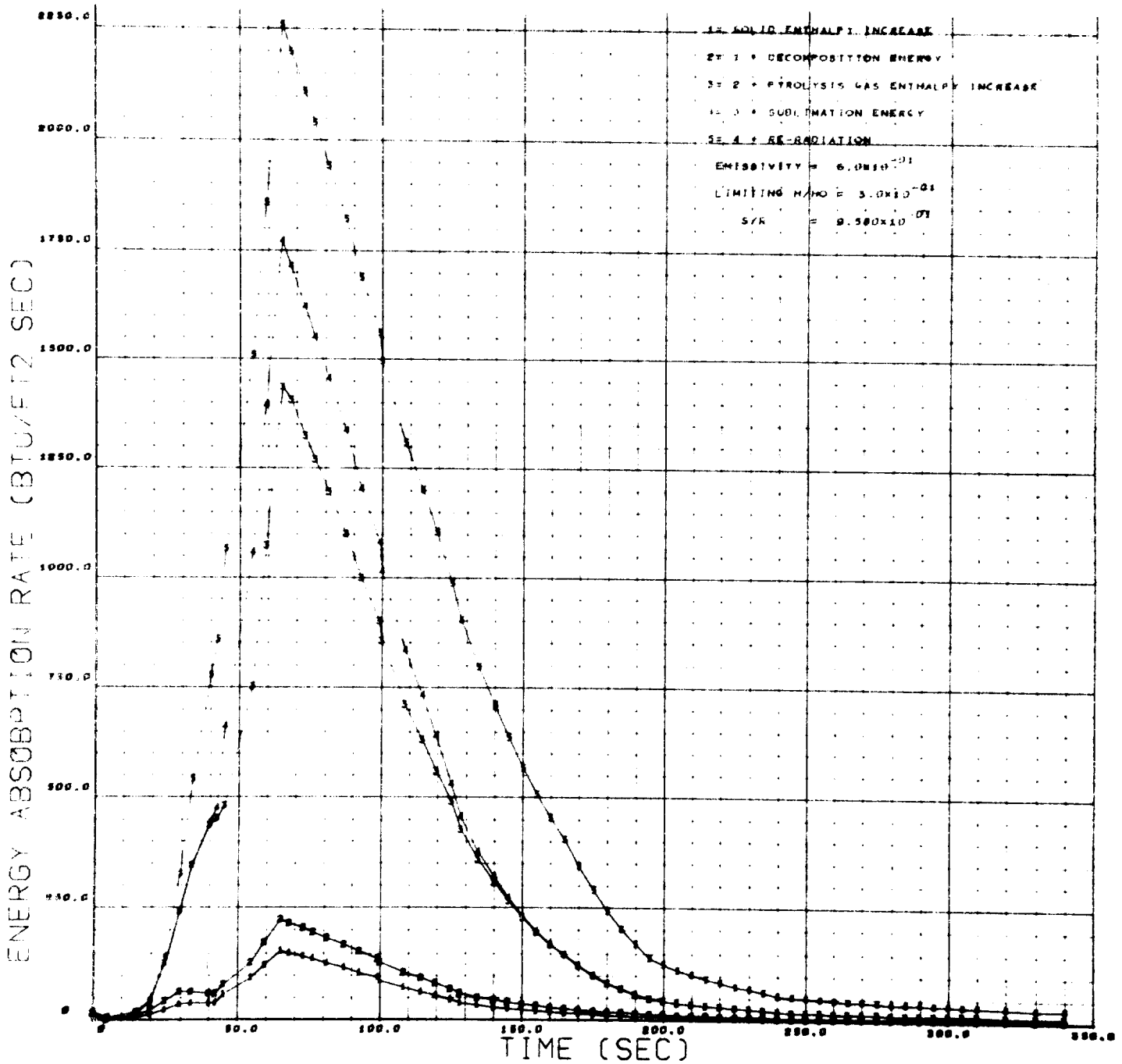


FIGURE A 89

HEATING RATE HISTORY

APOLLO 17K UB

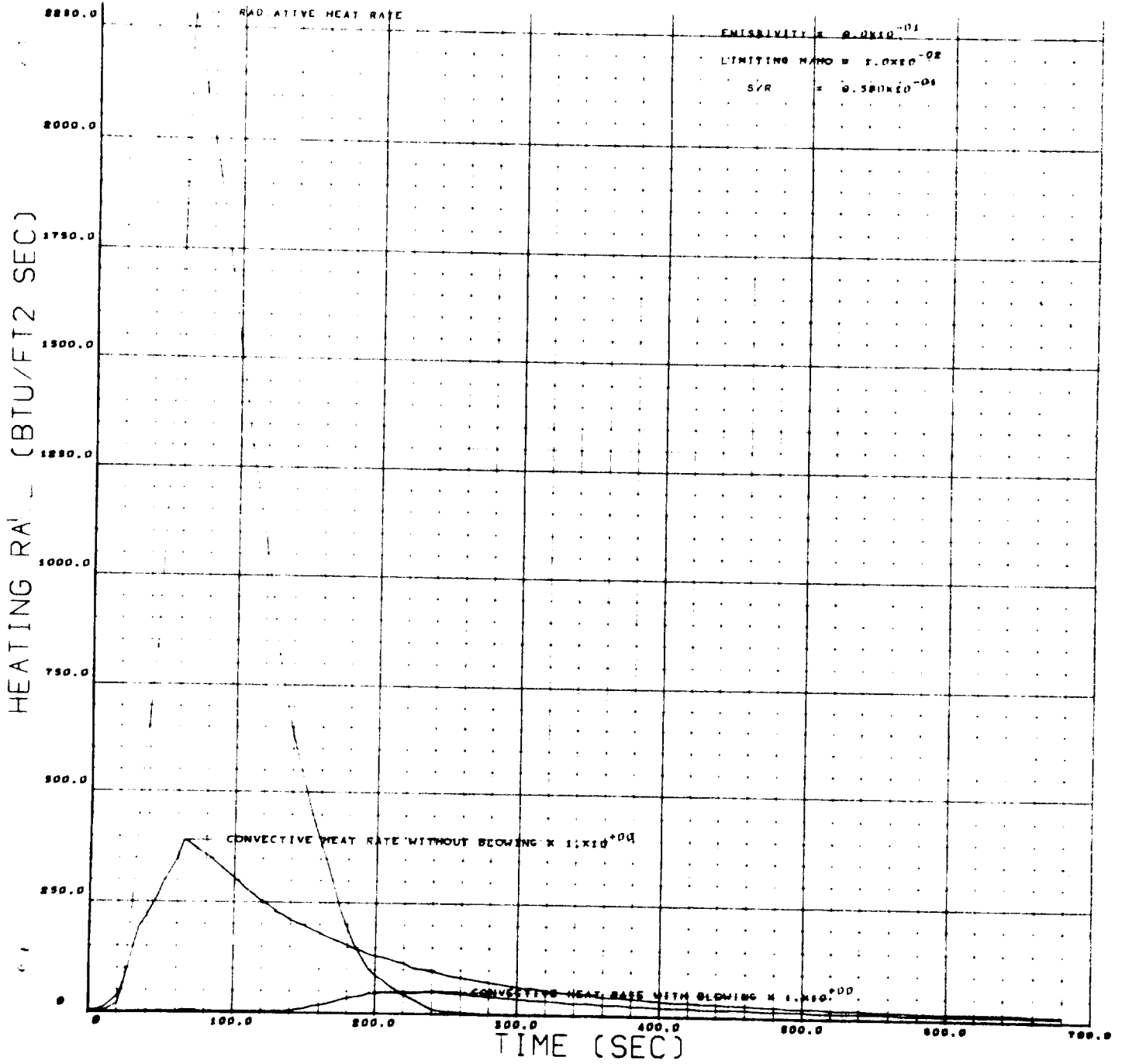


FIGURE A89

MATERIAL RESPONSE DATA

APOLLO 57K UB

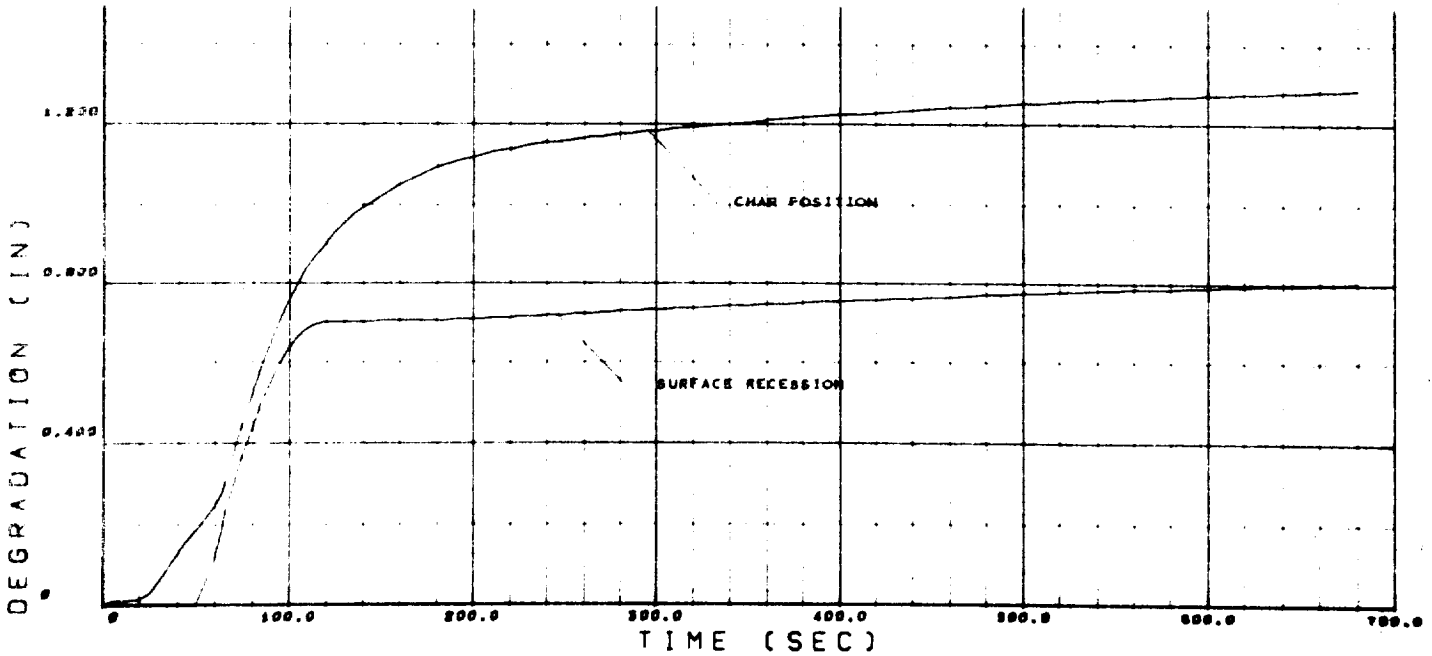
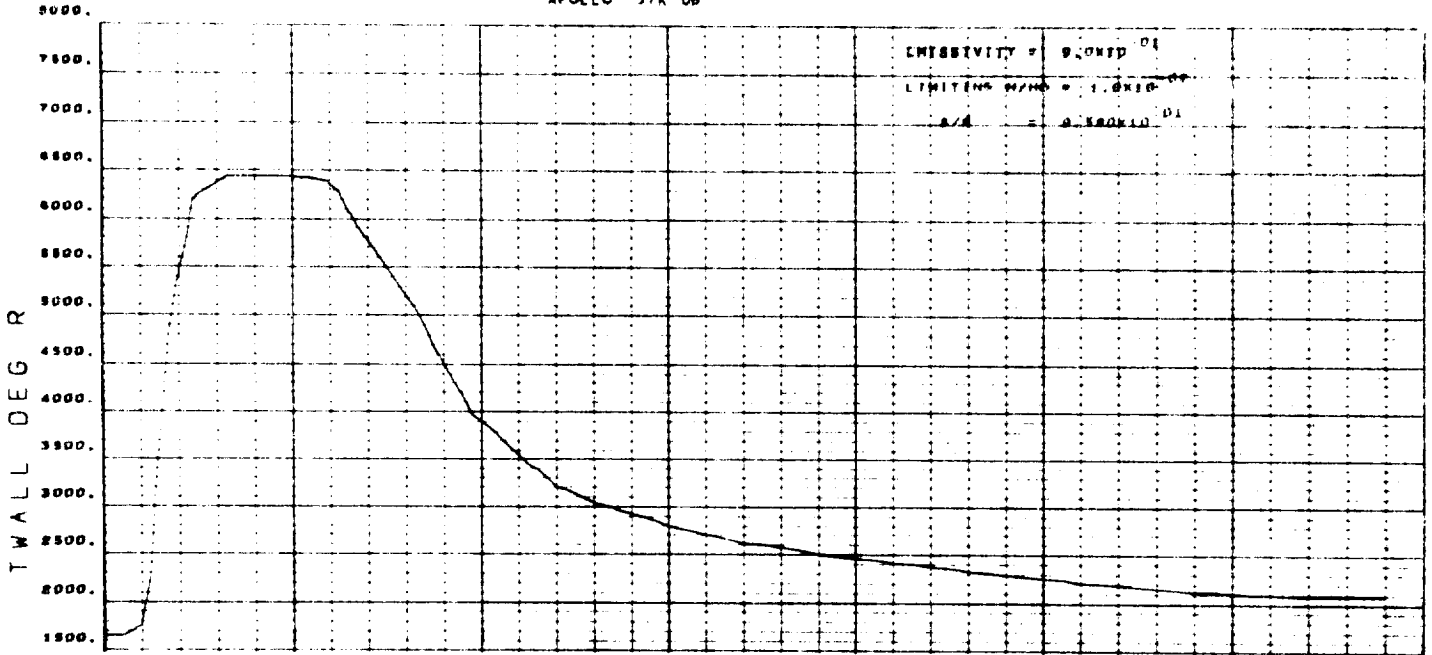


FIGURE A89

ENERGY ACCOMMODATION MECHANISMS

APOLLO 37K UB

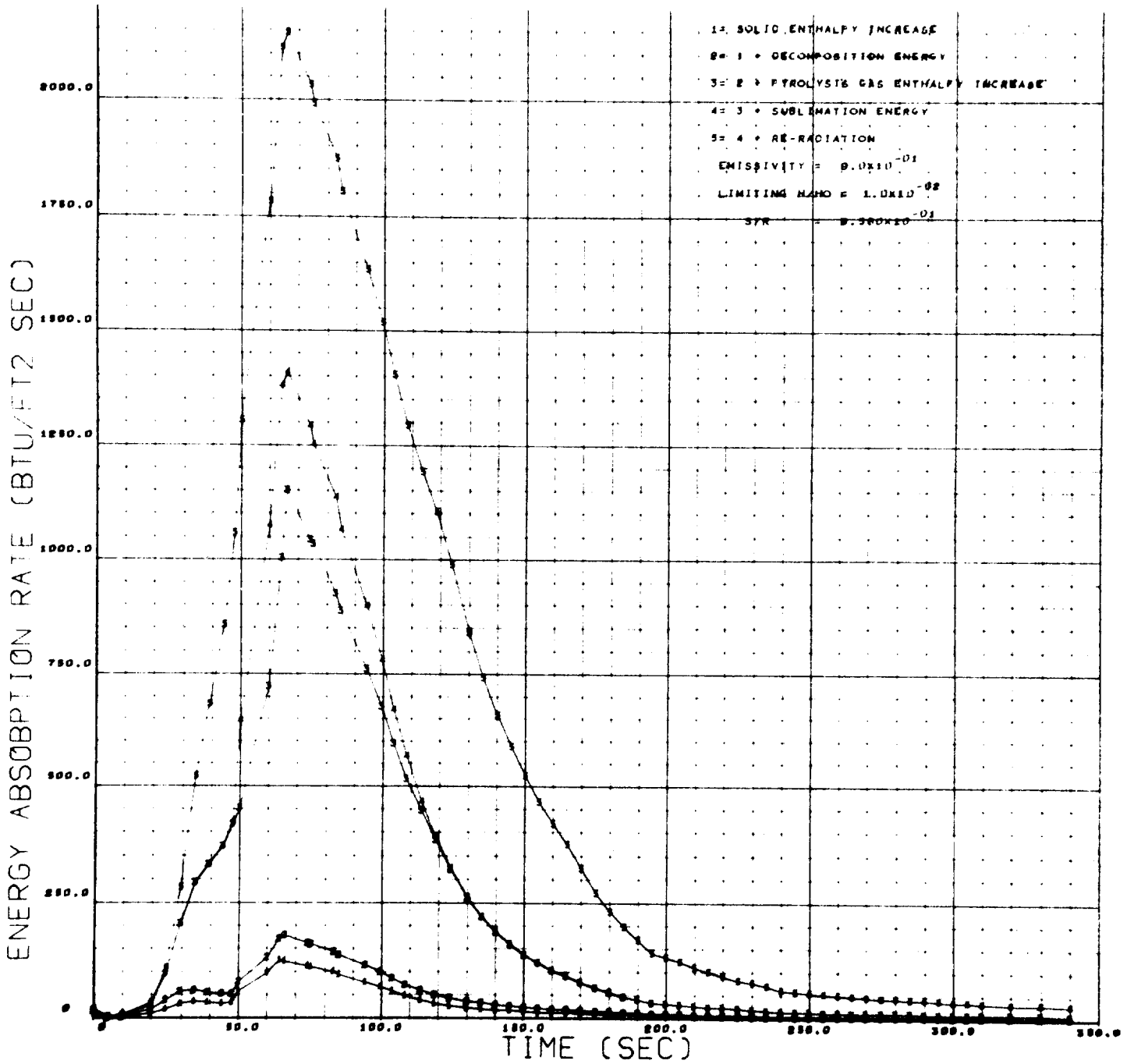


FIGURE A 90

HEATING RATE HISTORY

APOLLO 37K US

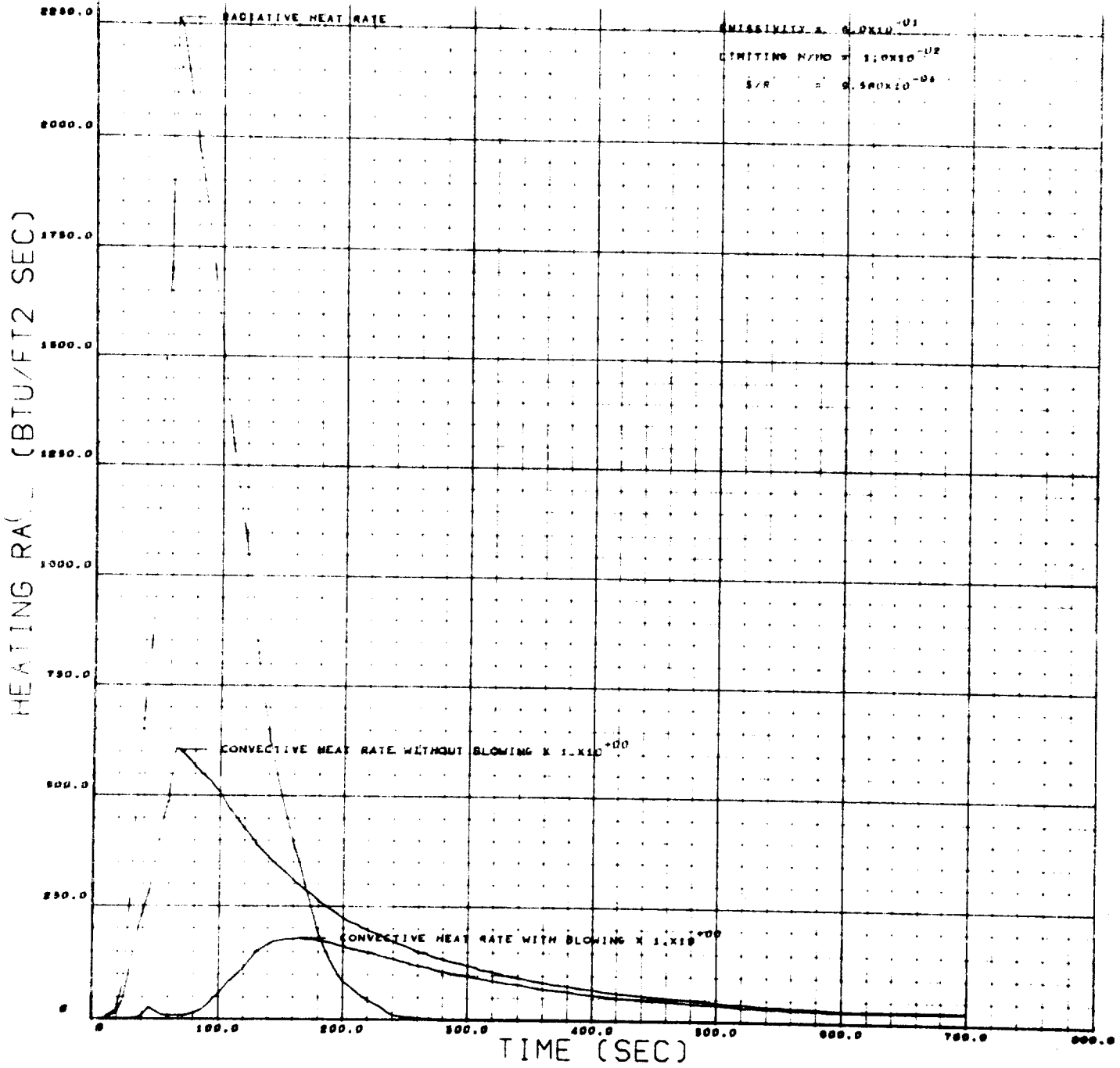


FIGURE A 90

MATERIAL RESPONSE DATA

APOLLO 57K UB

EMISSIVITY $\epsilon = 0.010 \pm 0.01$
LIMITING HAZO $\theta = 0.010 \pm 0.01$
SAR $\sigma = 0.0010 \pm 0.01$

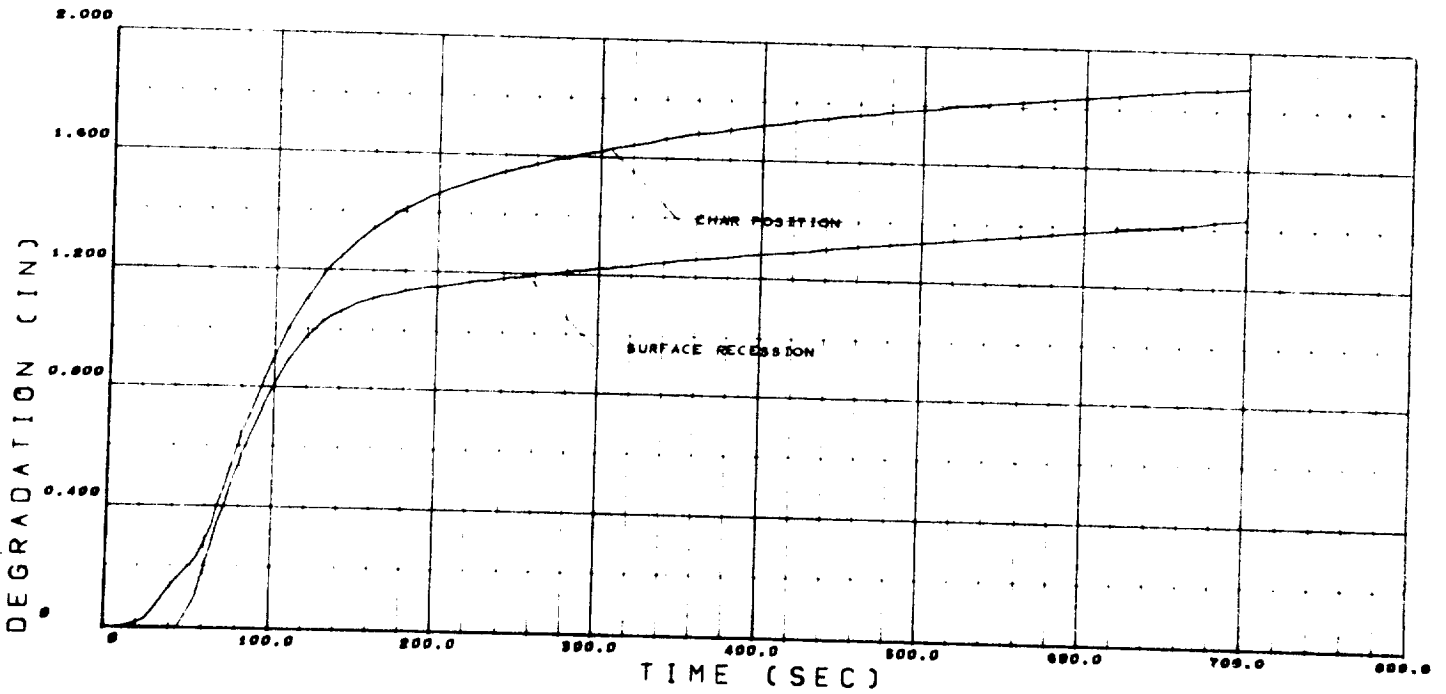
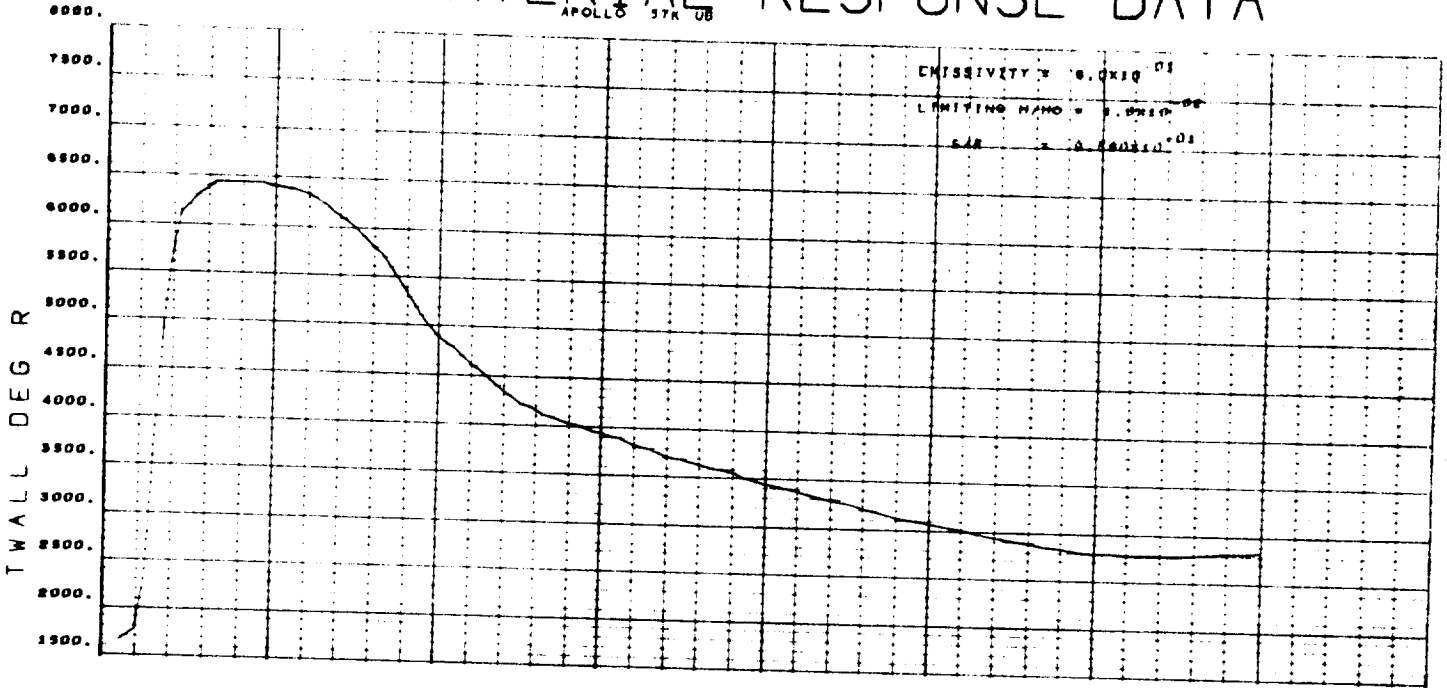


FIGURE A90

ENERGY ACCOMMODATION MECHANISMS

APOLLO 17K UB

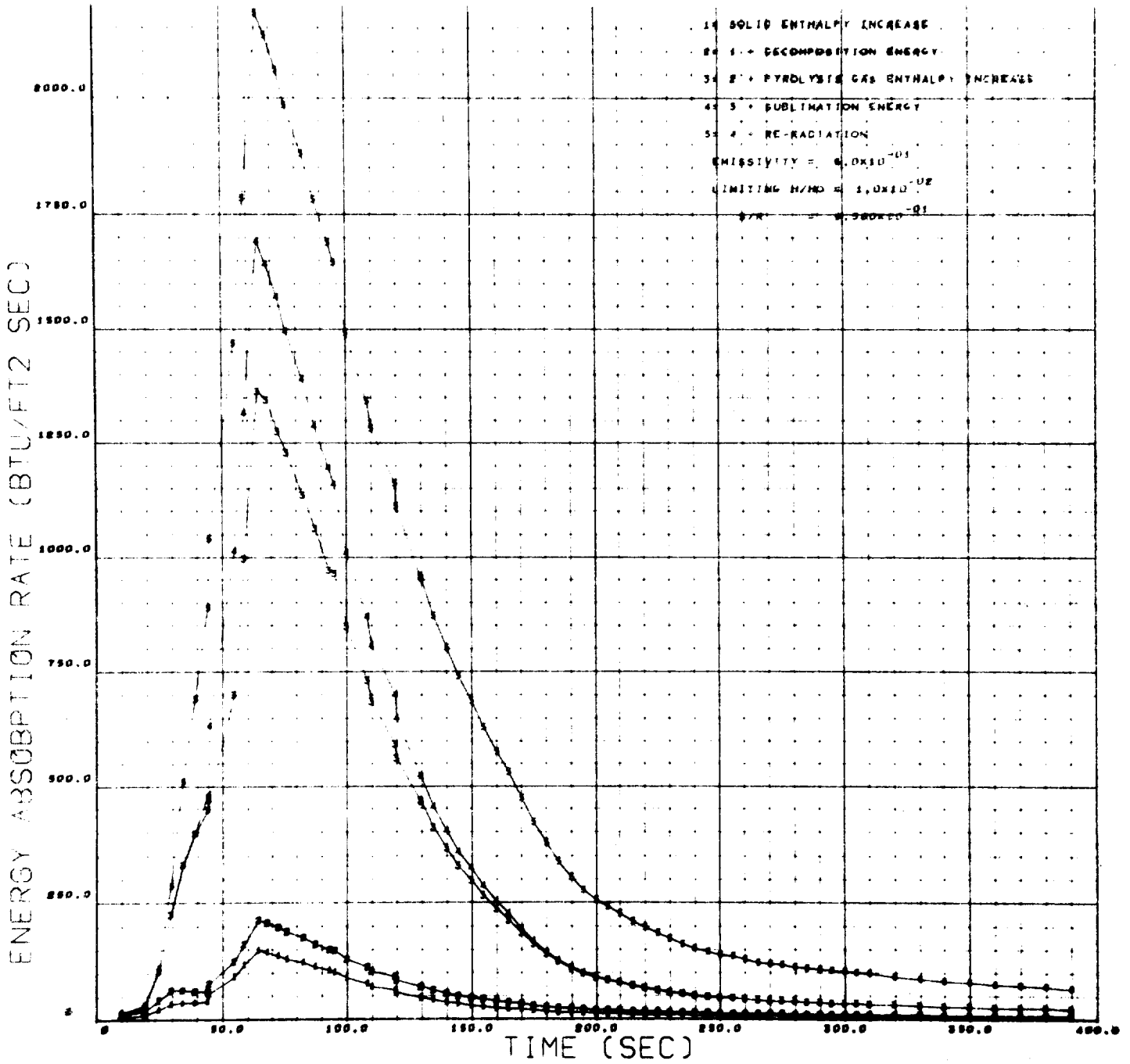


FIGURE A 91

HEATING RATE HISTORY

APOLLO 37K UB

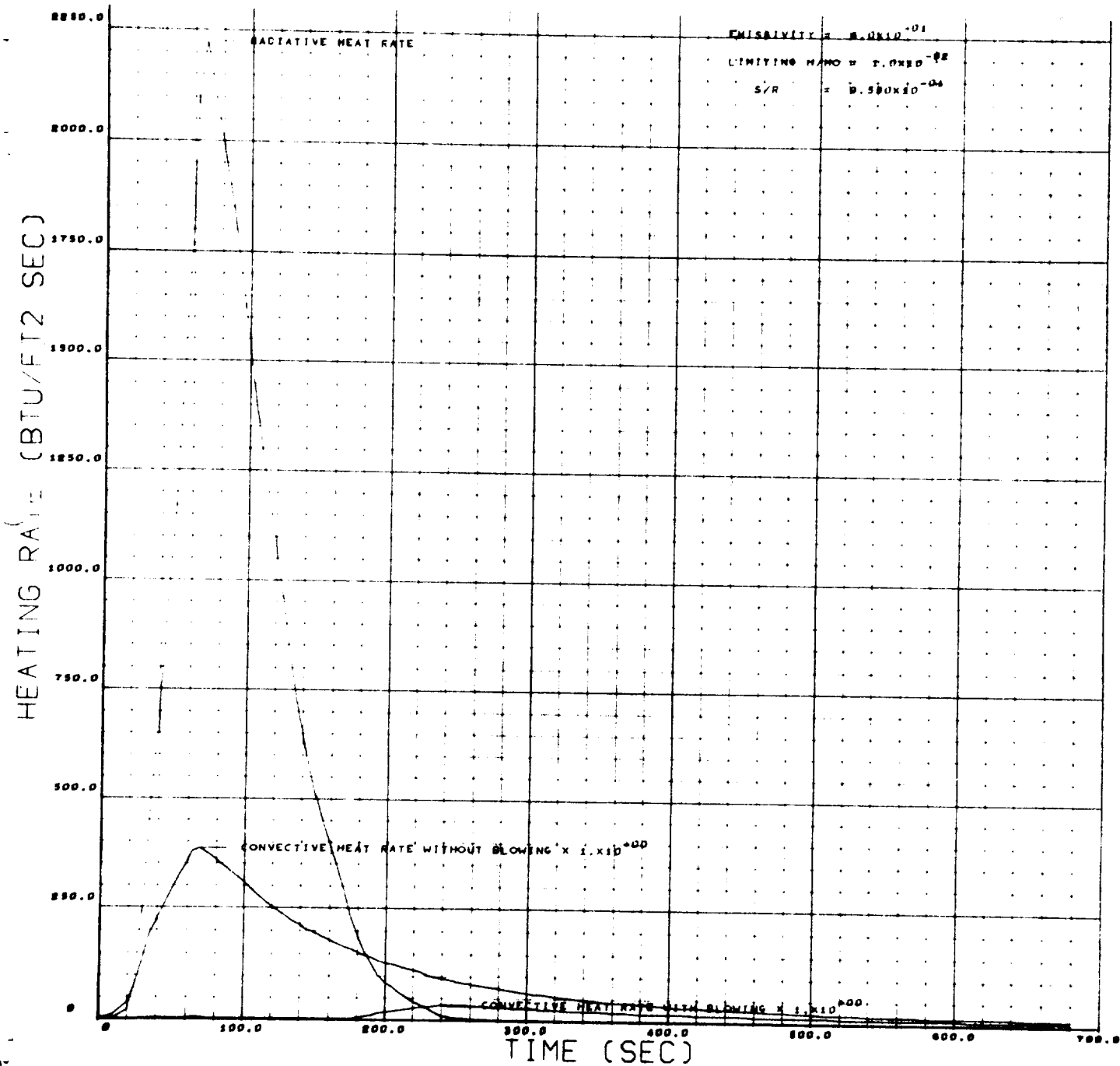


FIGURE A 91

MATERIAL RESPONSE DATA

APOLLO 37K UB

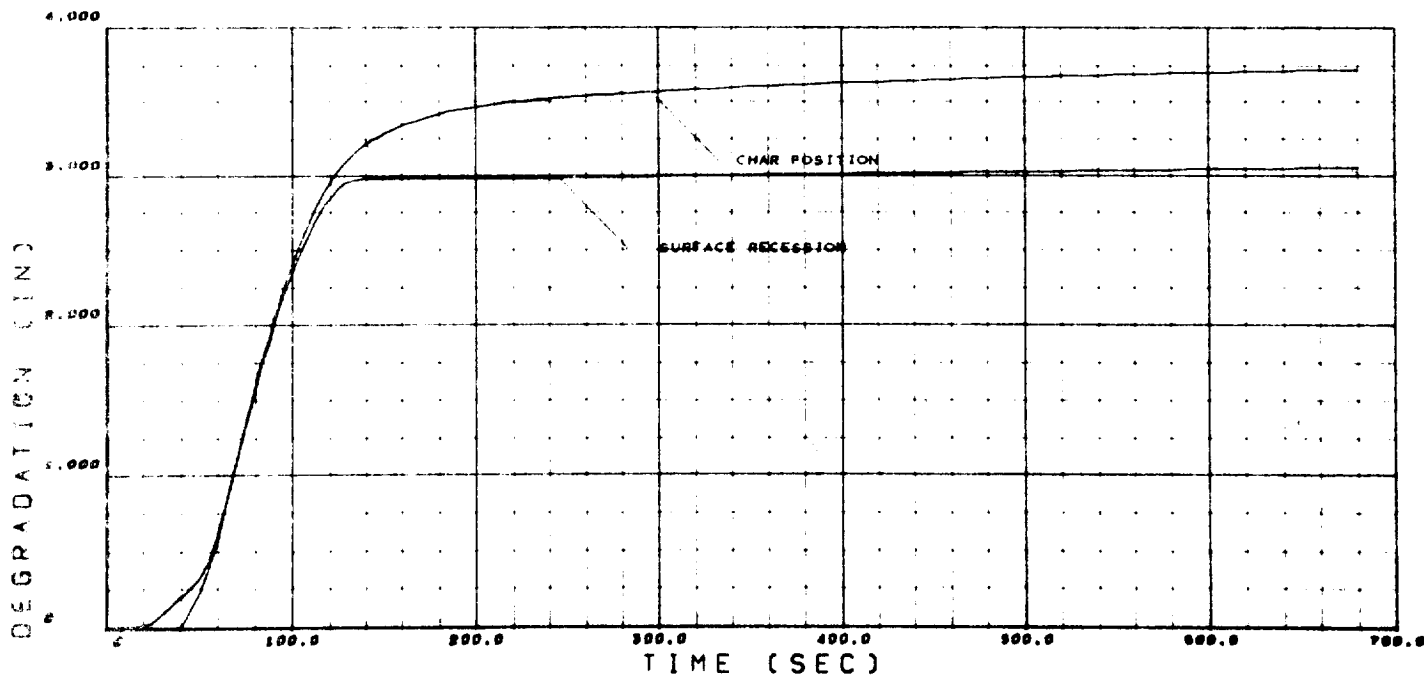
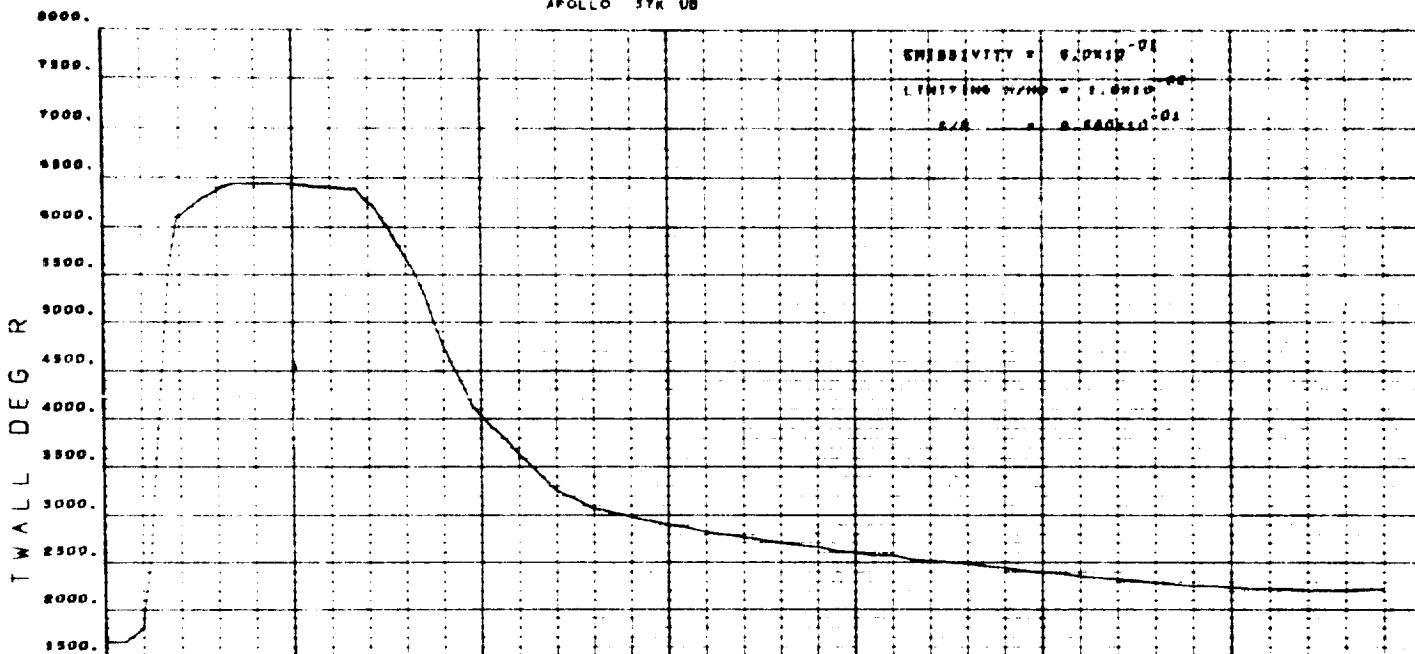


FIGURE A91

ENERGY ACCOMMODATION MECHANISMS

APOLLO 57X UB

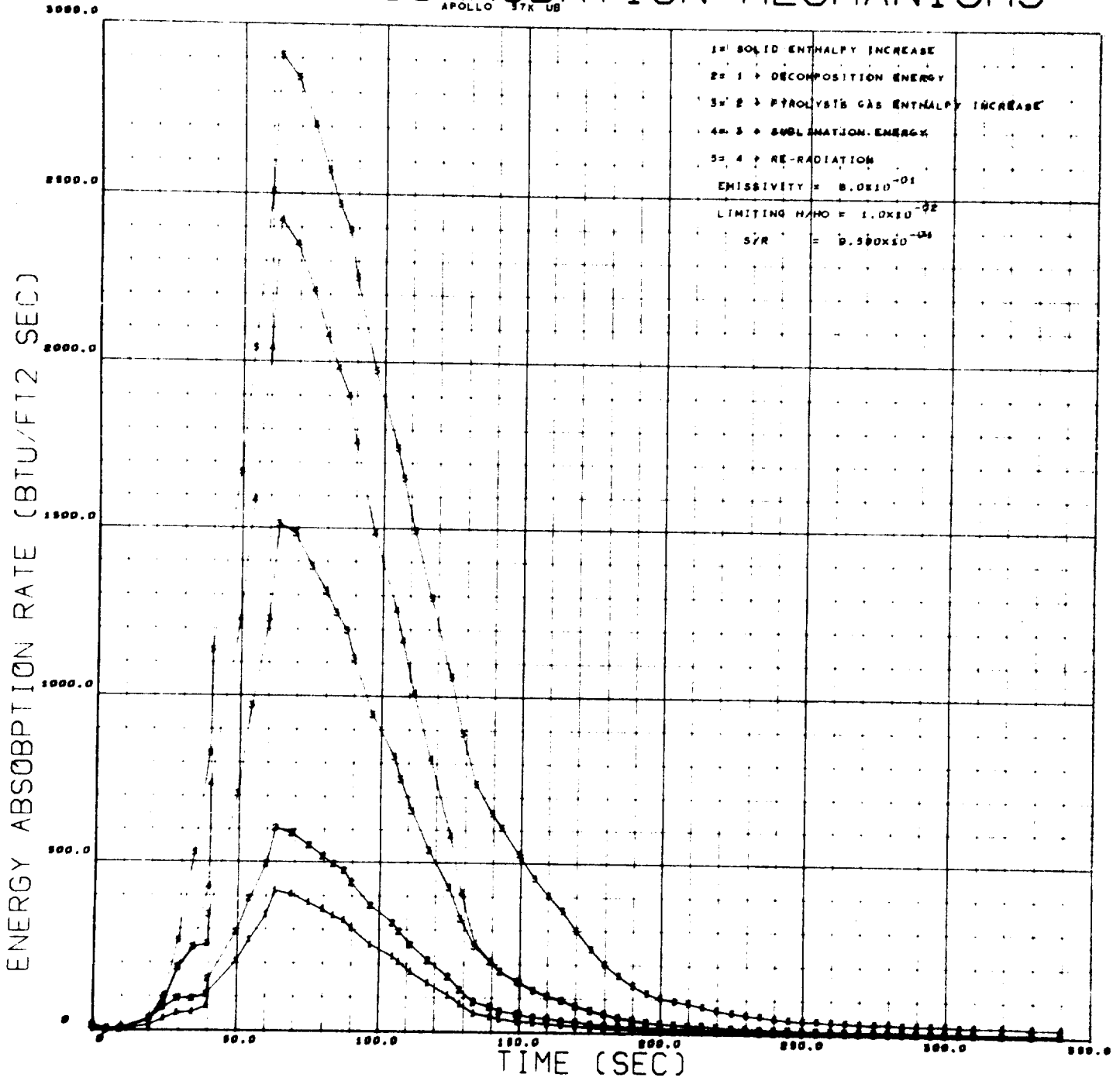


FIGURE A 92

HEATING RATE HISTORY

APOLLO 37K UD

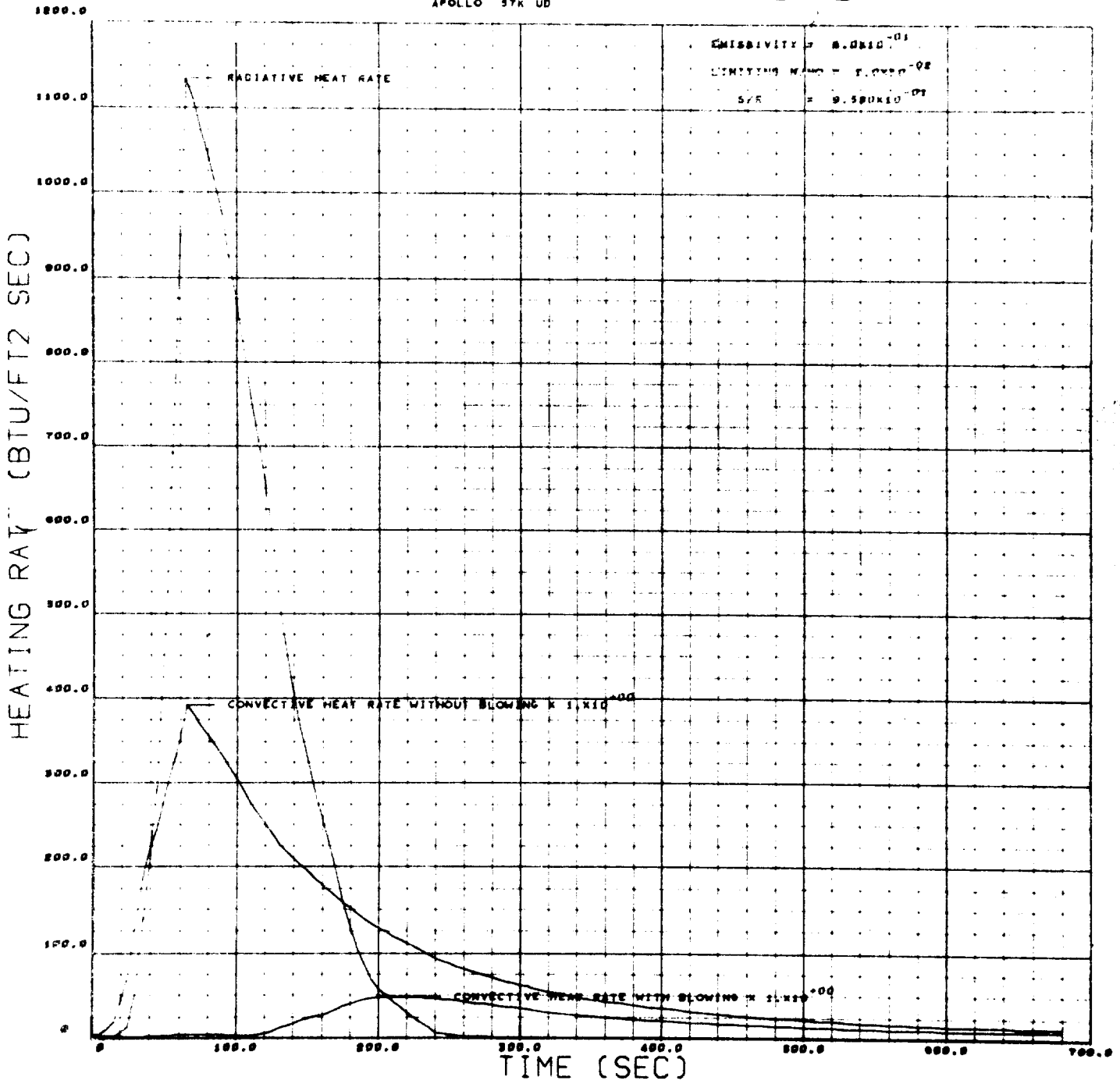


FIGURE A 92

MATERIAL RESPONSE DATA

APOLLO 37K UB

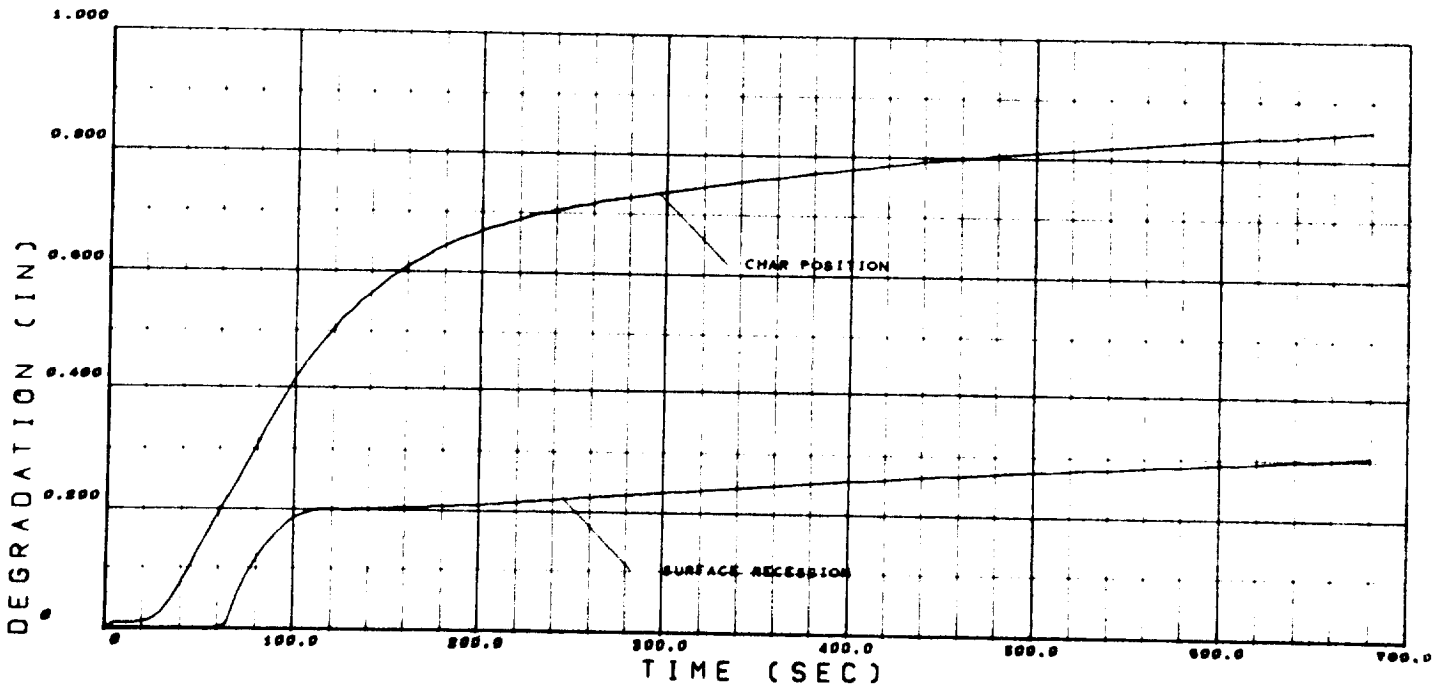
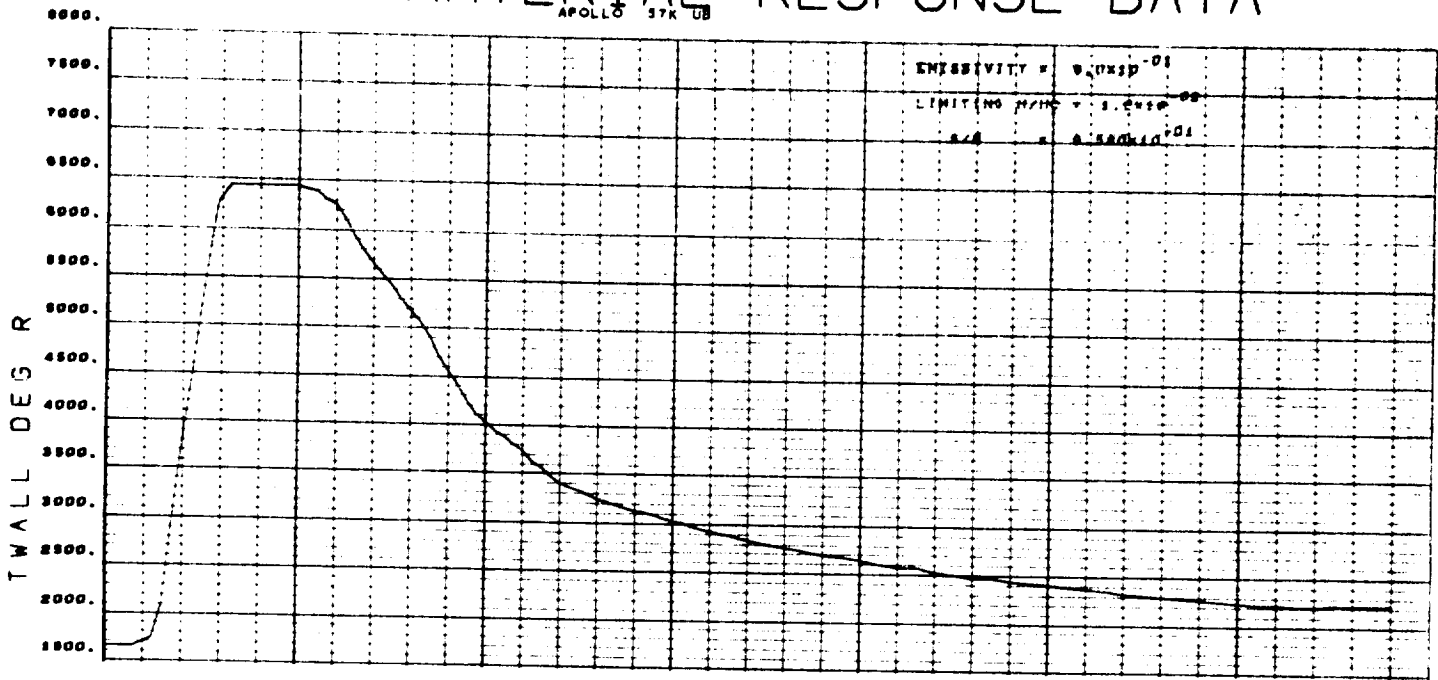


FIGURE A 92

ENERGY ACCOMMODATION MECHANISMS

APOLLO 37K LB

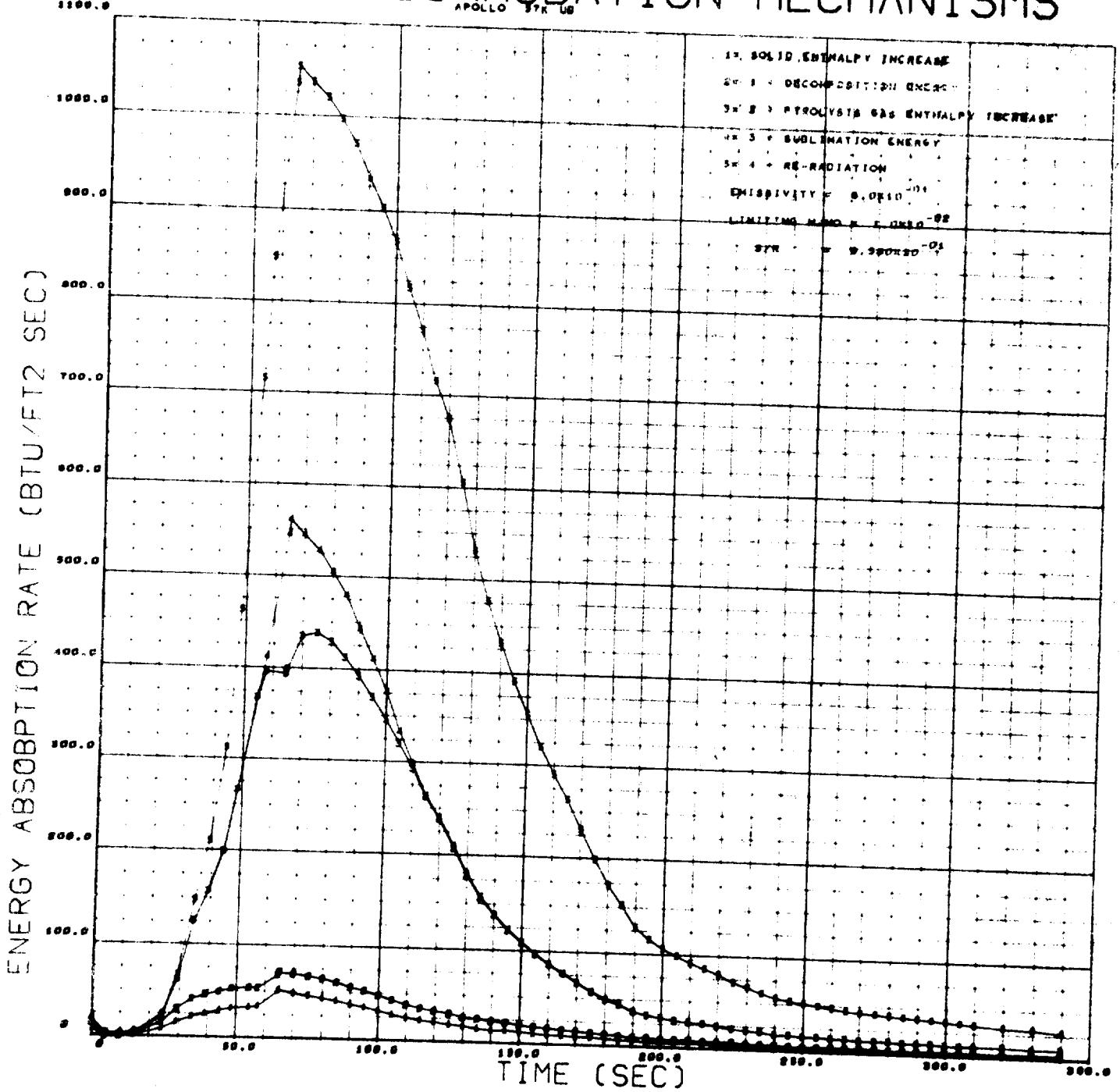


FIGURE 193

HEATING RATE HISTORY

APOLLO 17K US

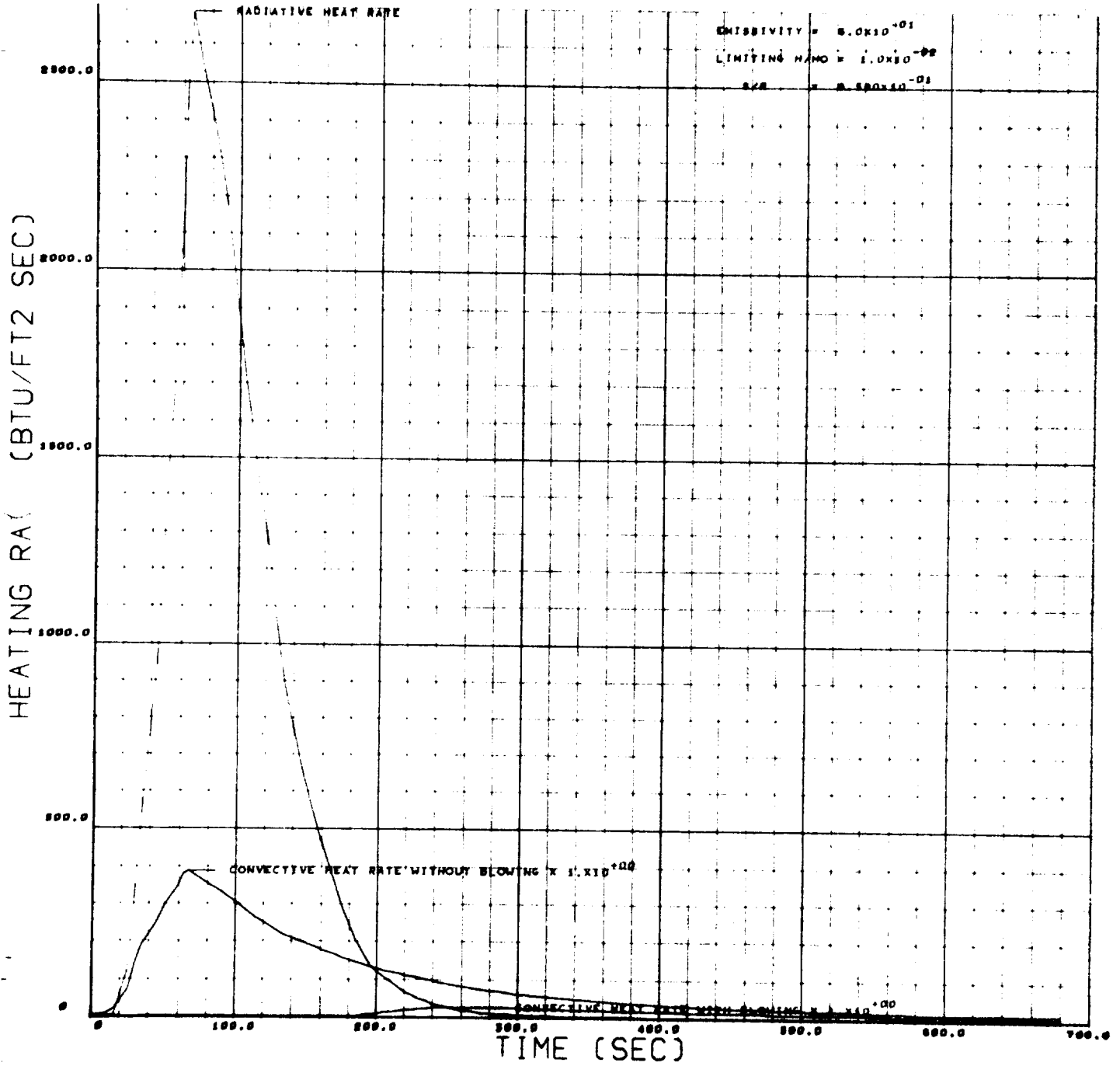


FIGURE A 93

MATERIAL RESPONSE DATA

APOLLO 17K US

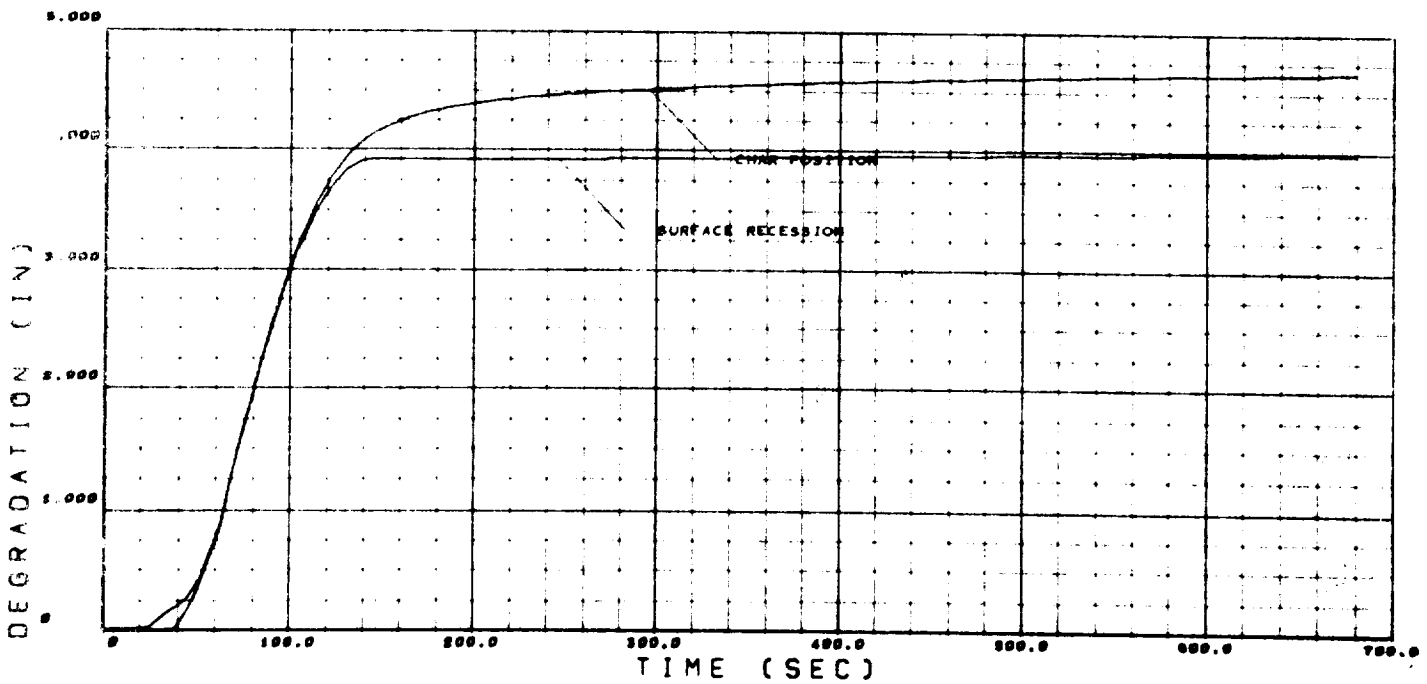
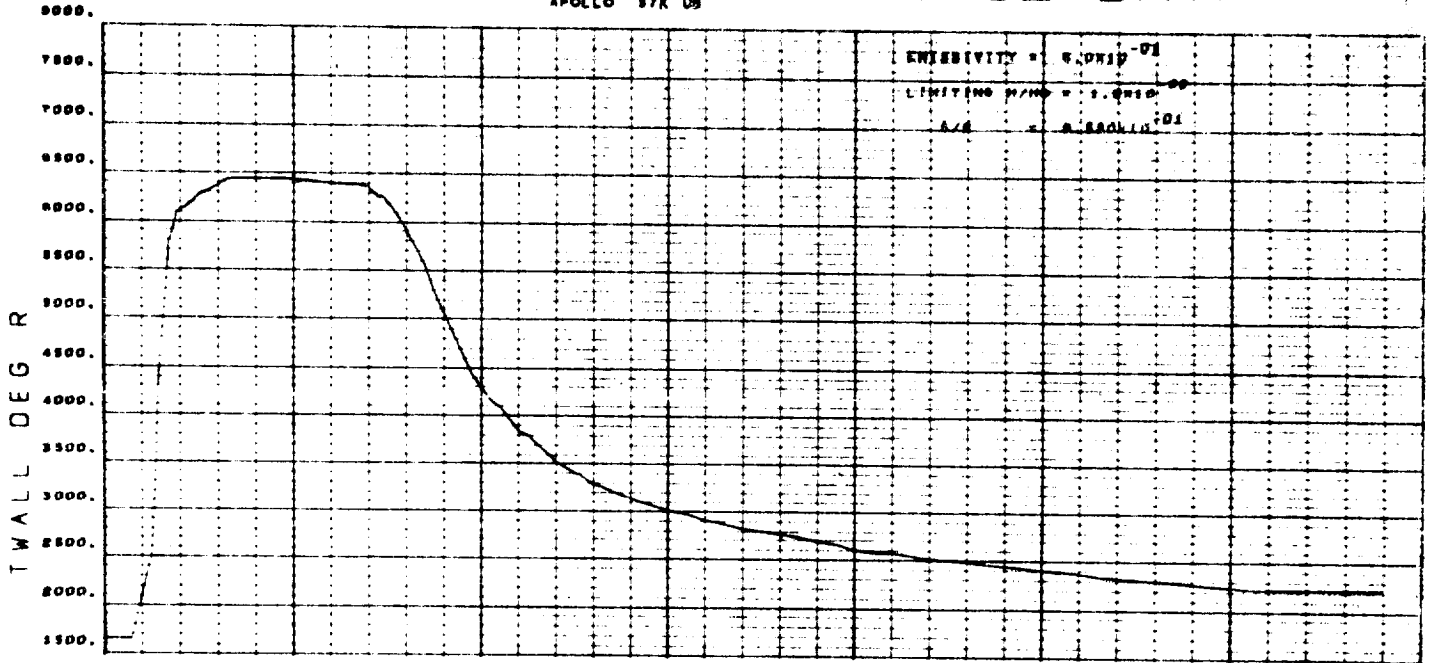


FIGURE A93

ENERGY ACCOMMODATION MECHANISMS

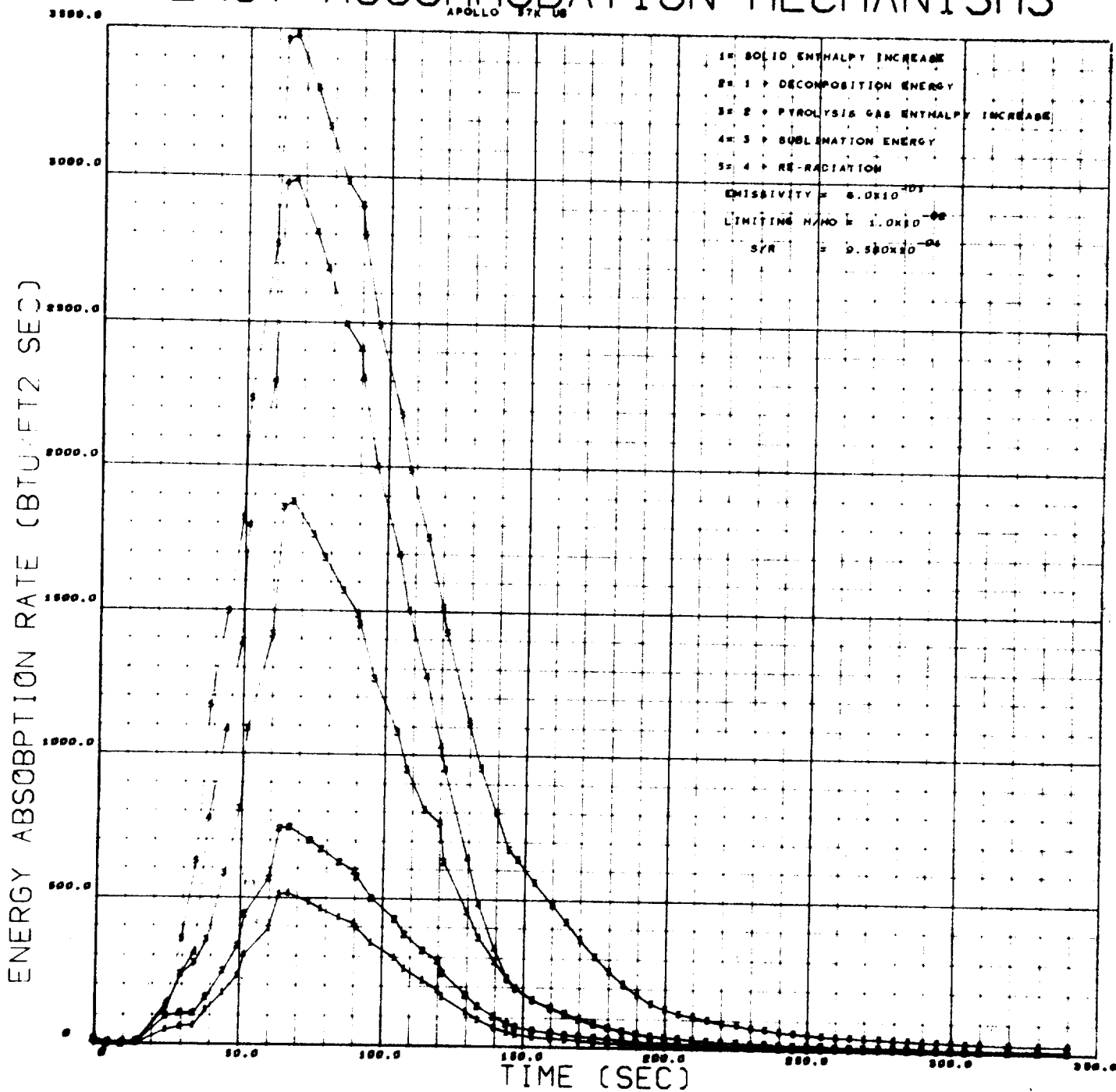


FIGURE A99

HEATING RATE HISTORY

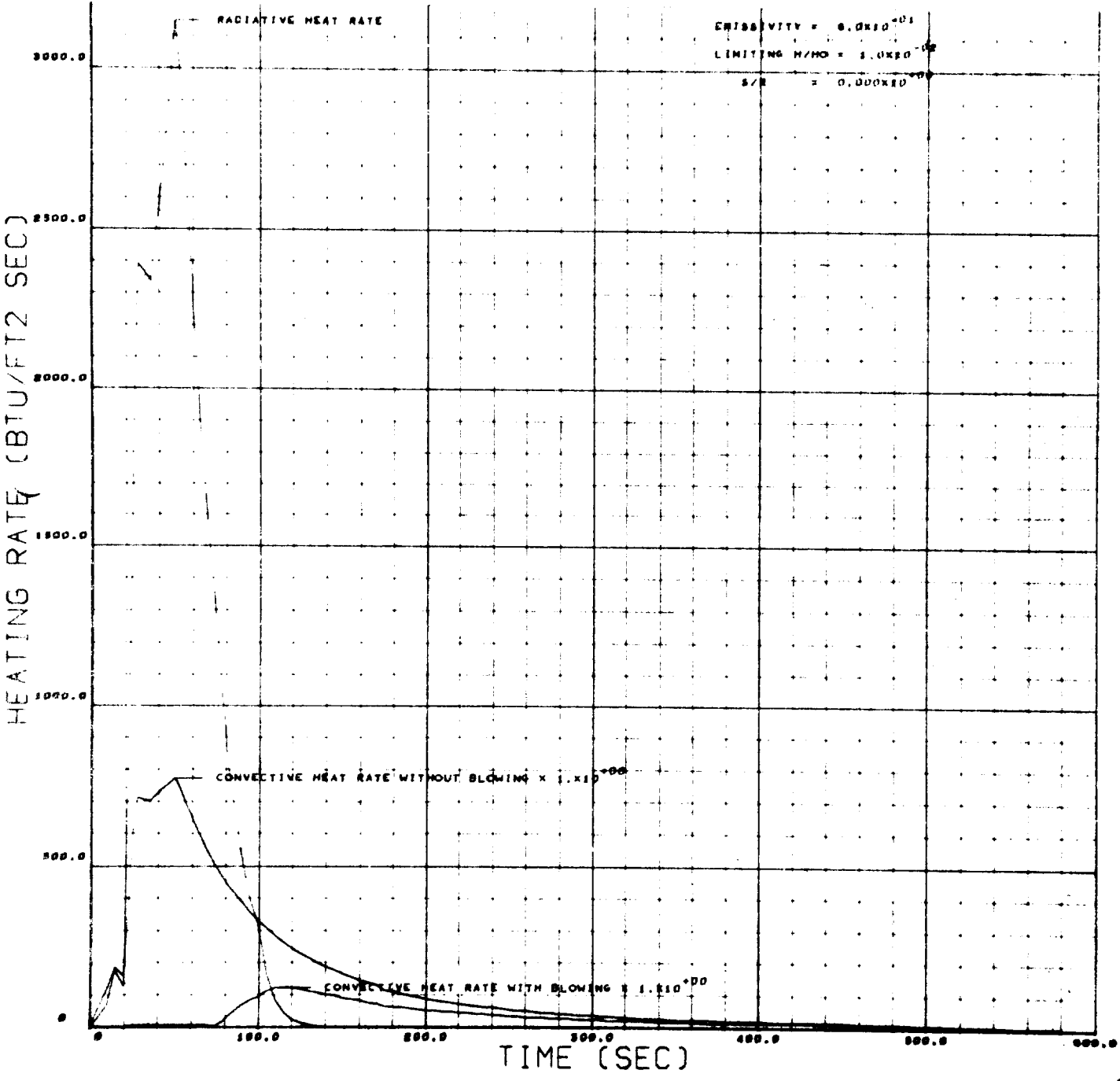


FIGURE A94

MATERIAL RESPONSE DATA

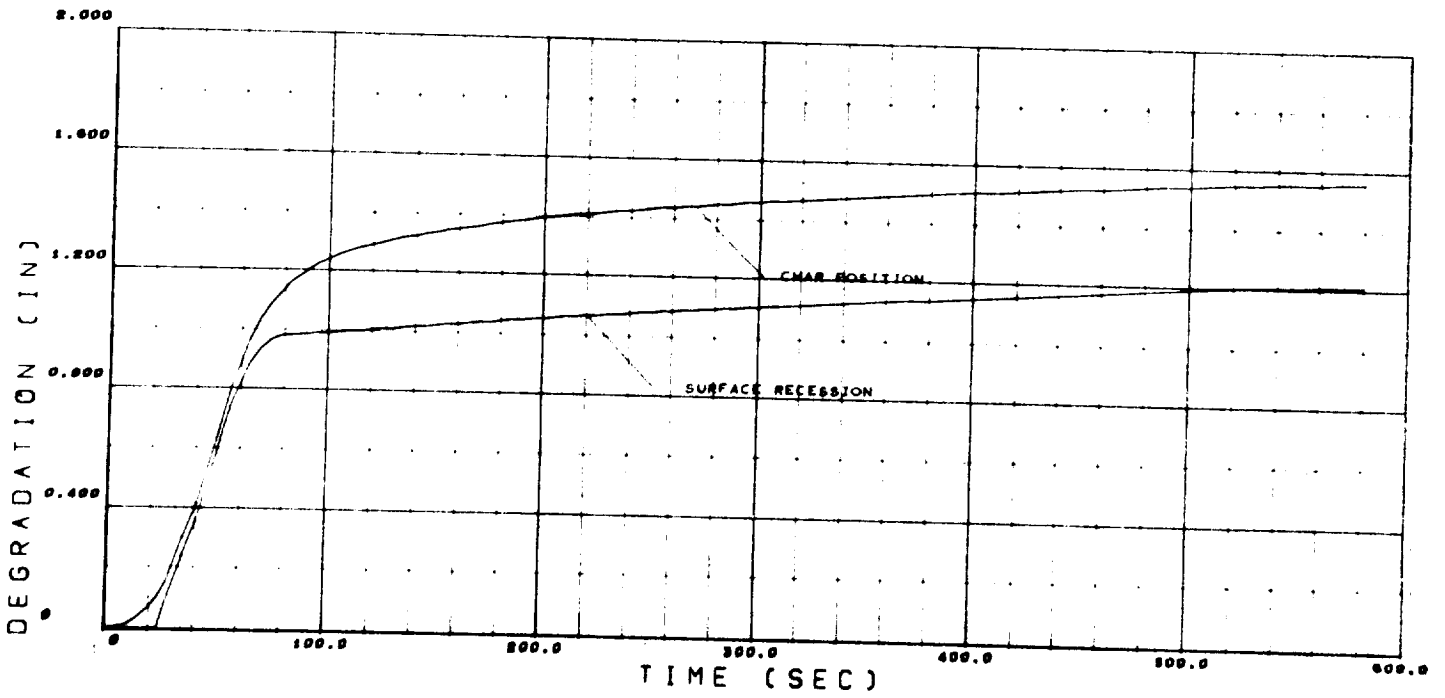
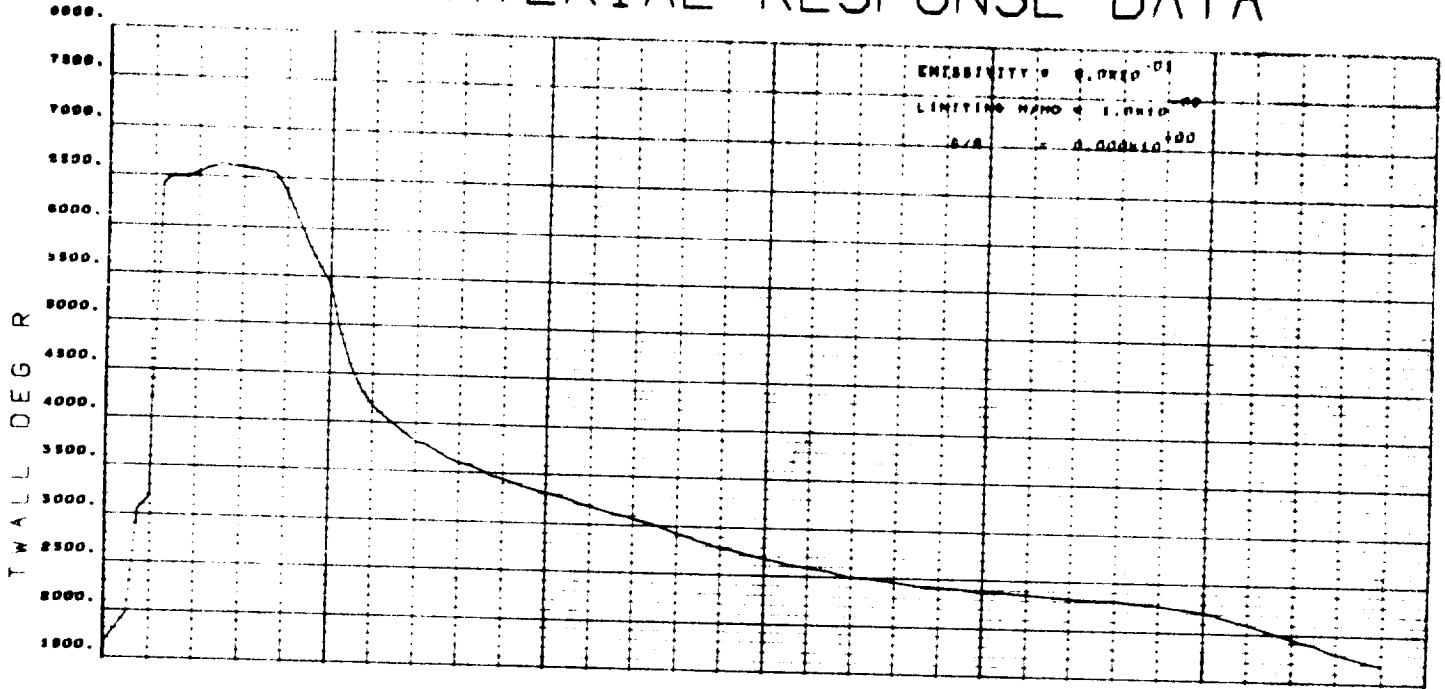


FIGURE A 94

ENERGY ACCOMMODATION MECHANISMS

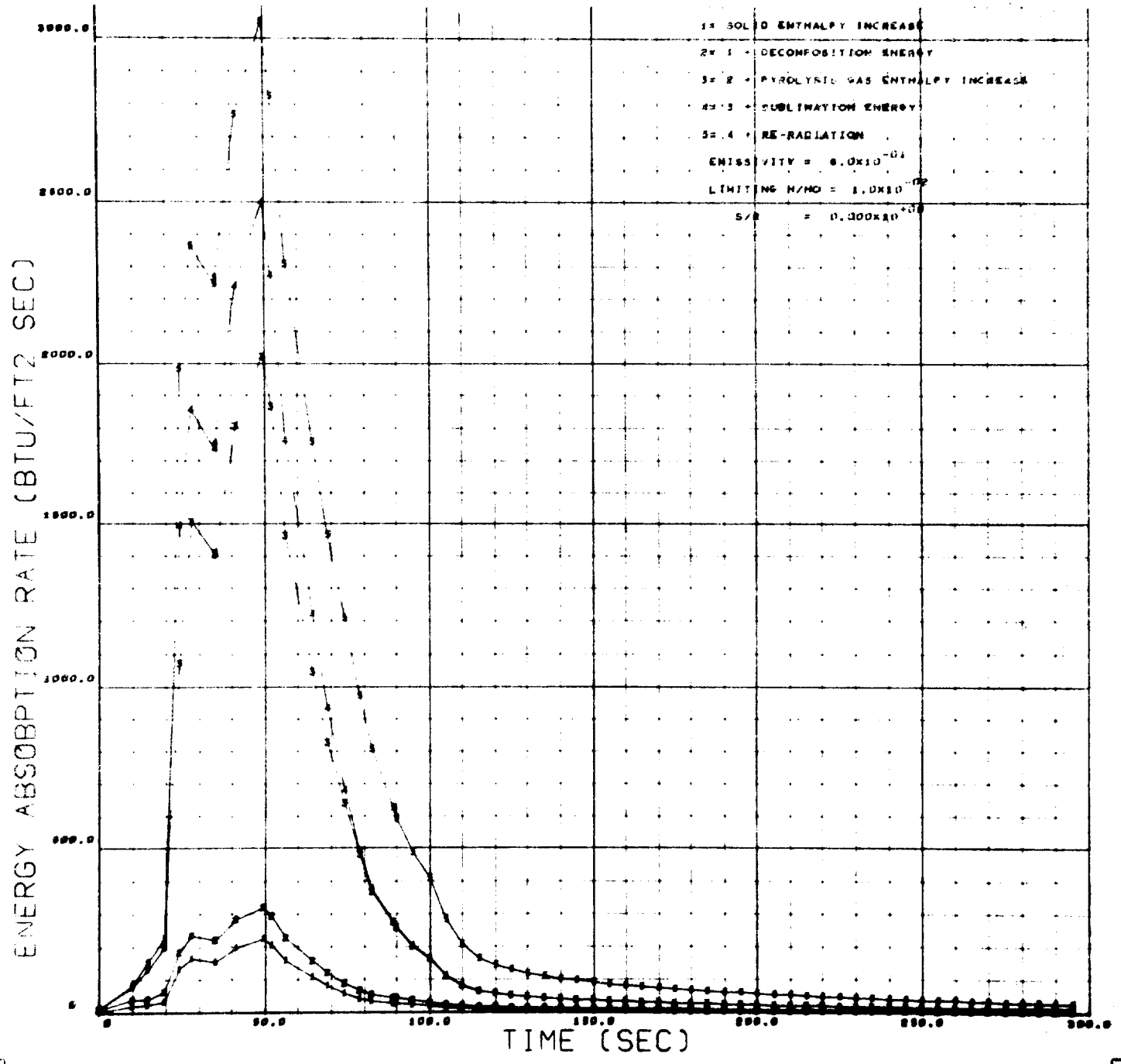


FIGURE A 95

HEATING RATE HISTORY

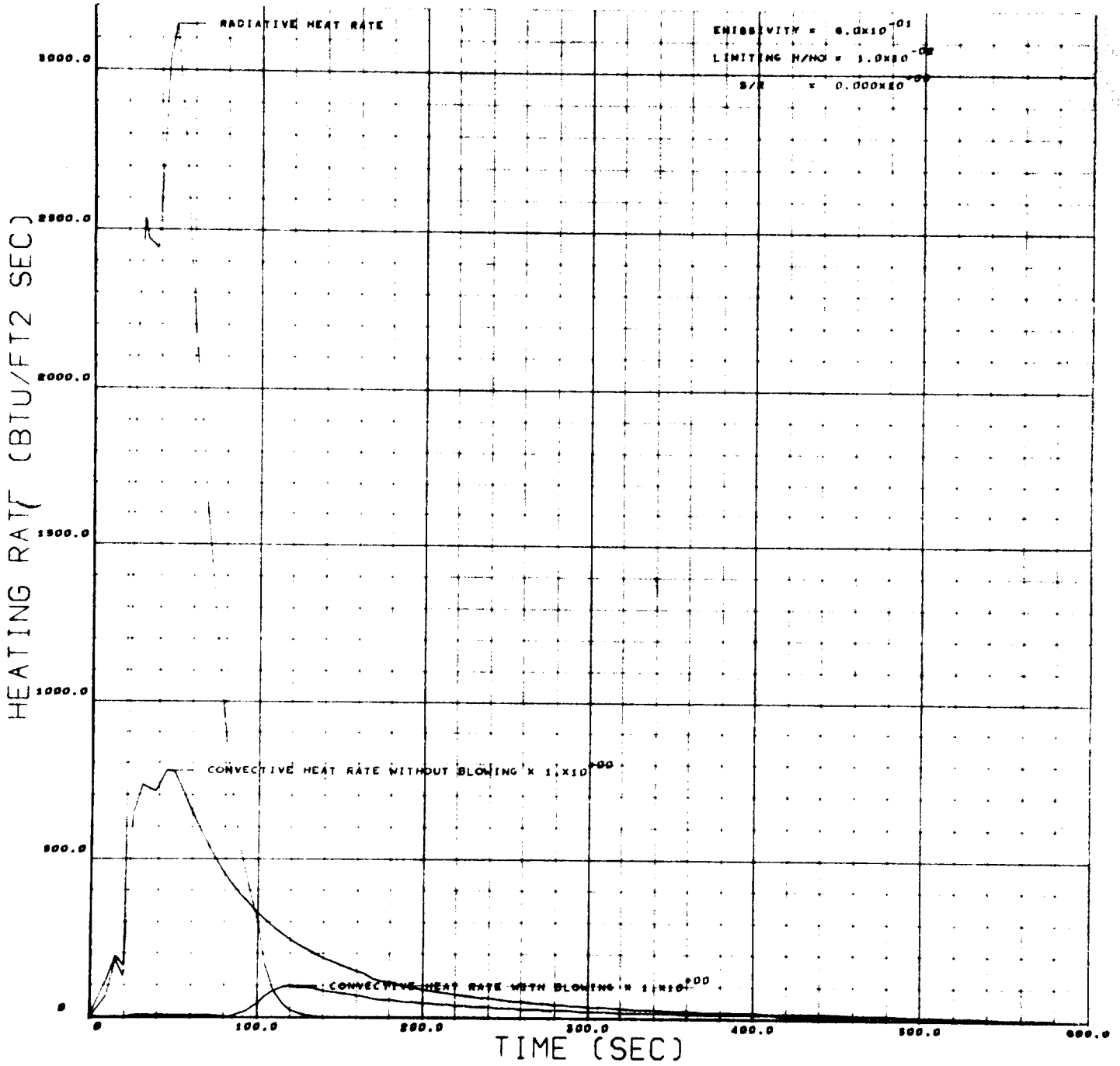


FIGURE A 95

MATERIAL RESPONSE DATA

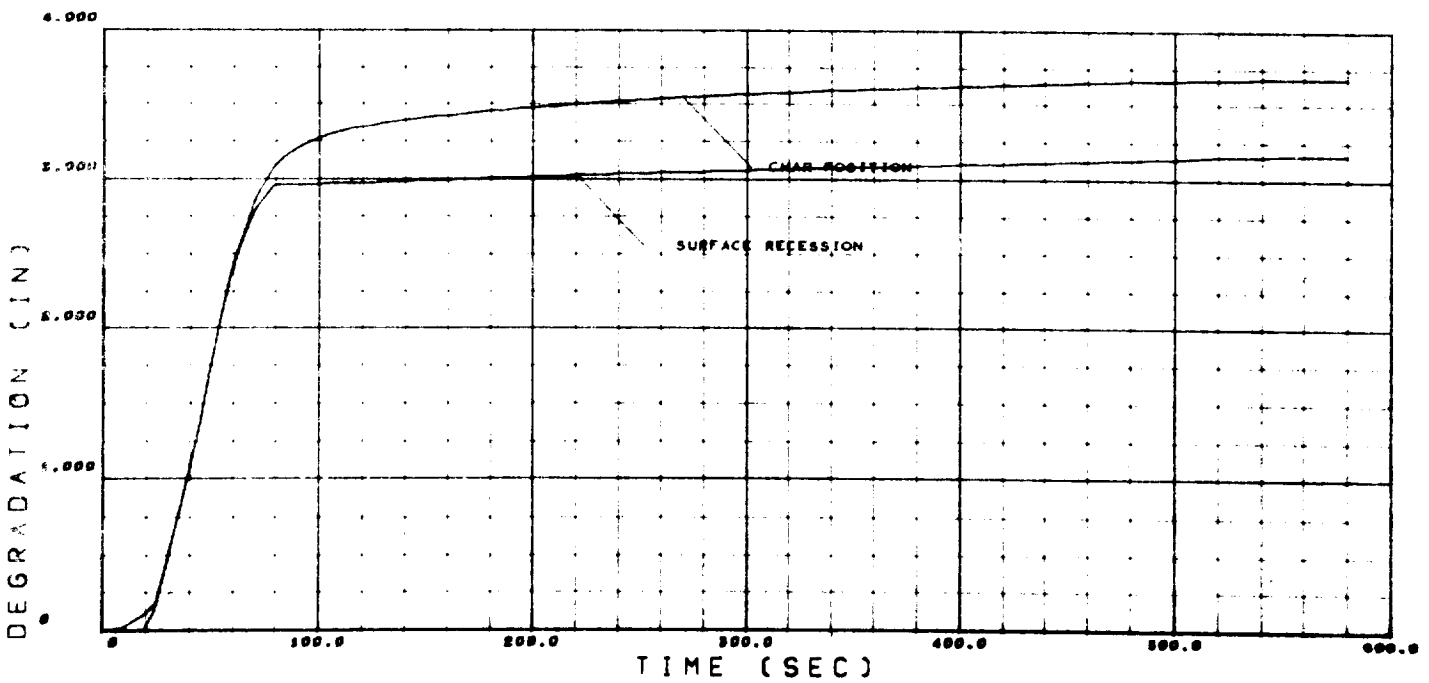
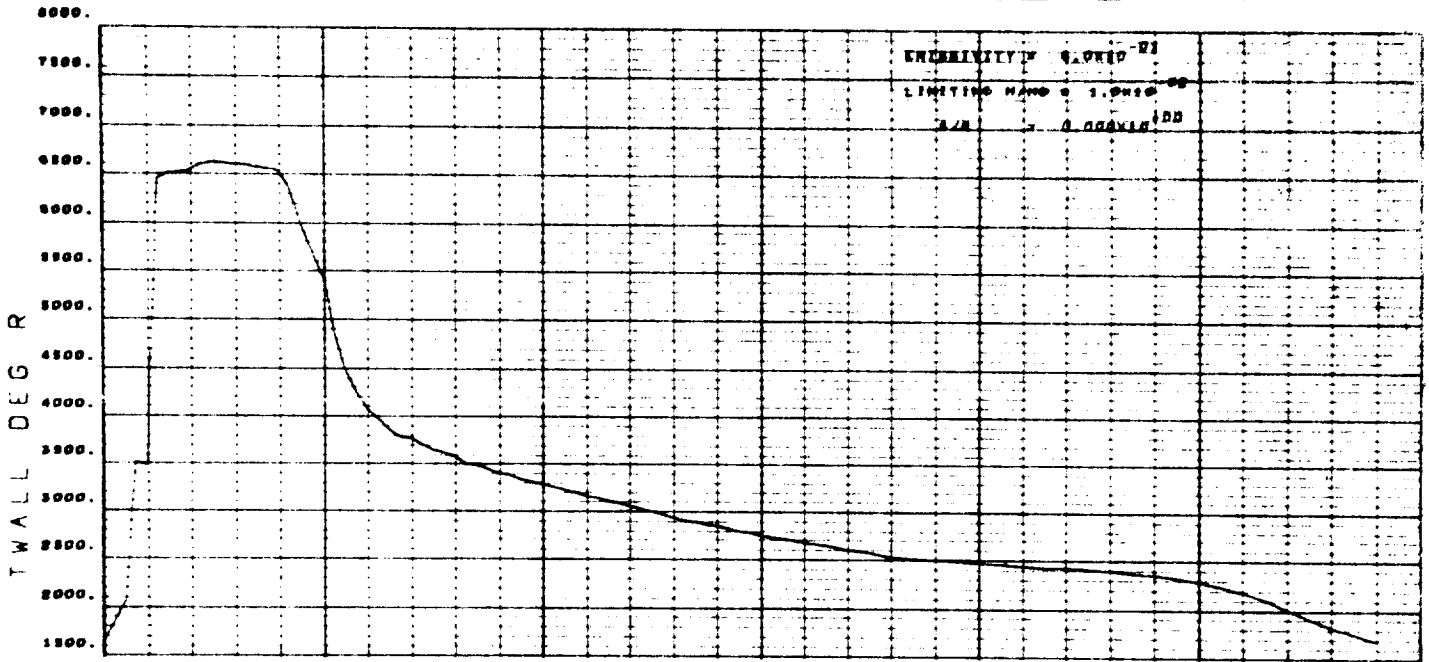


FIGURE A95

ENERGY ACCOMMODATION MECHANISMS

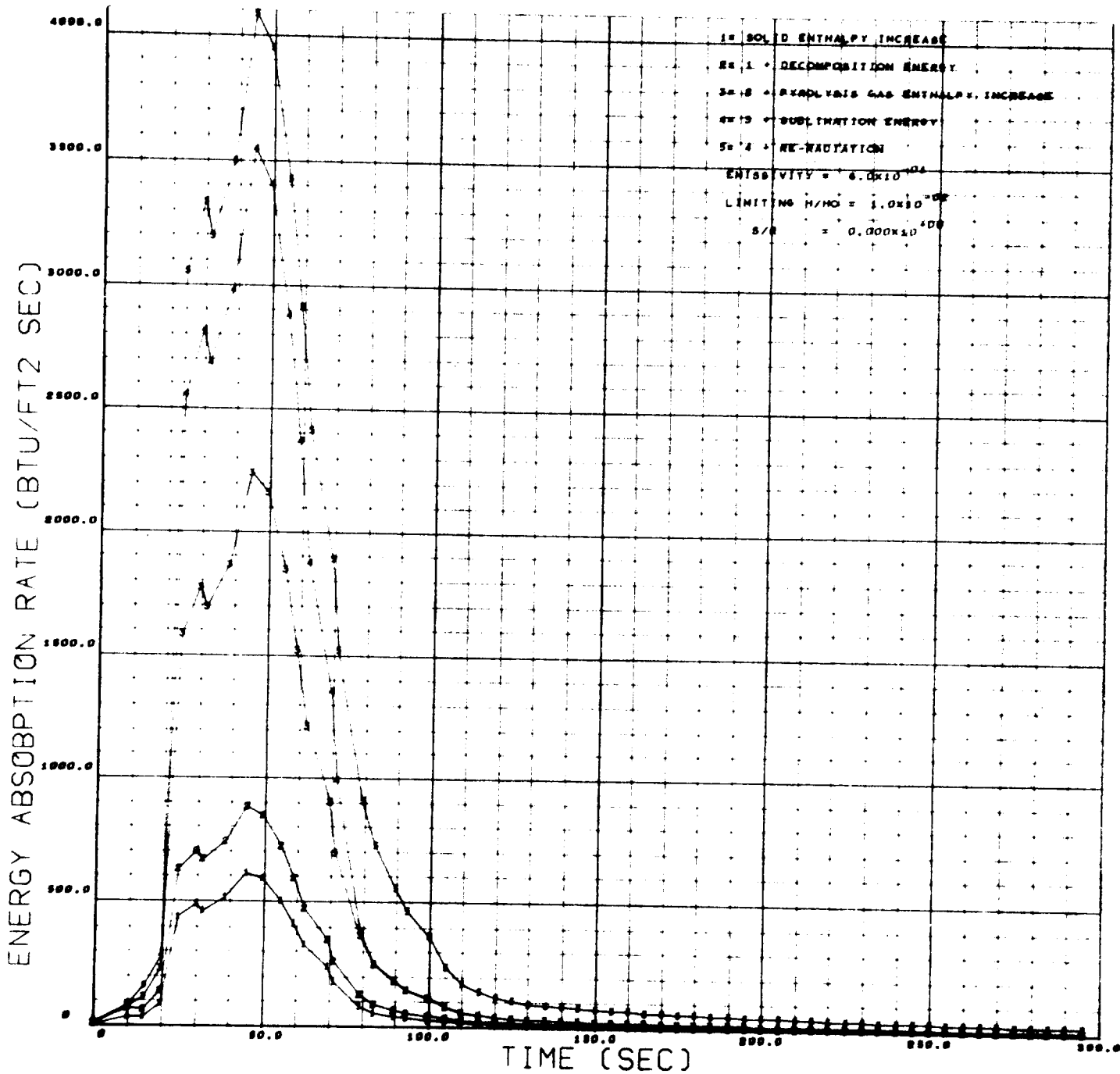


FIGURE A 96

HEATING RATE HISTORY

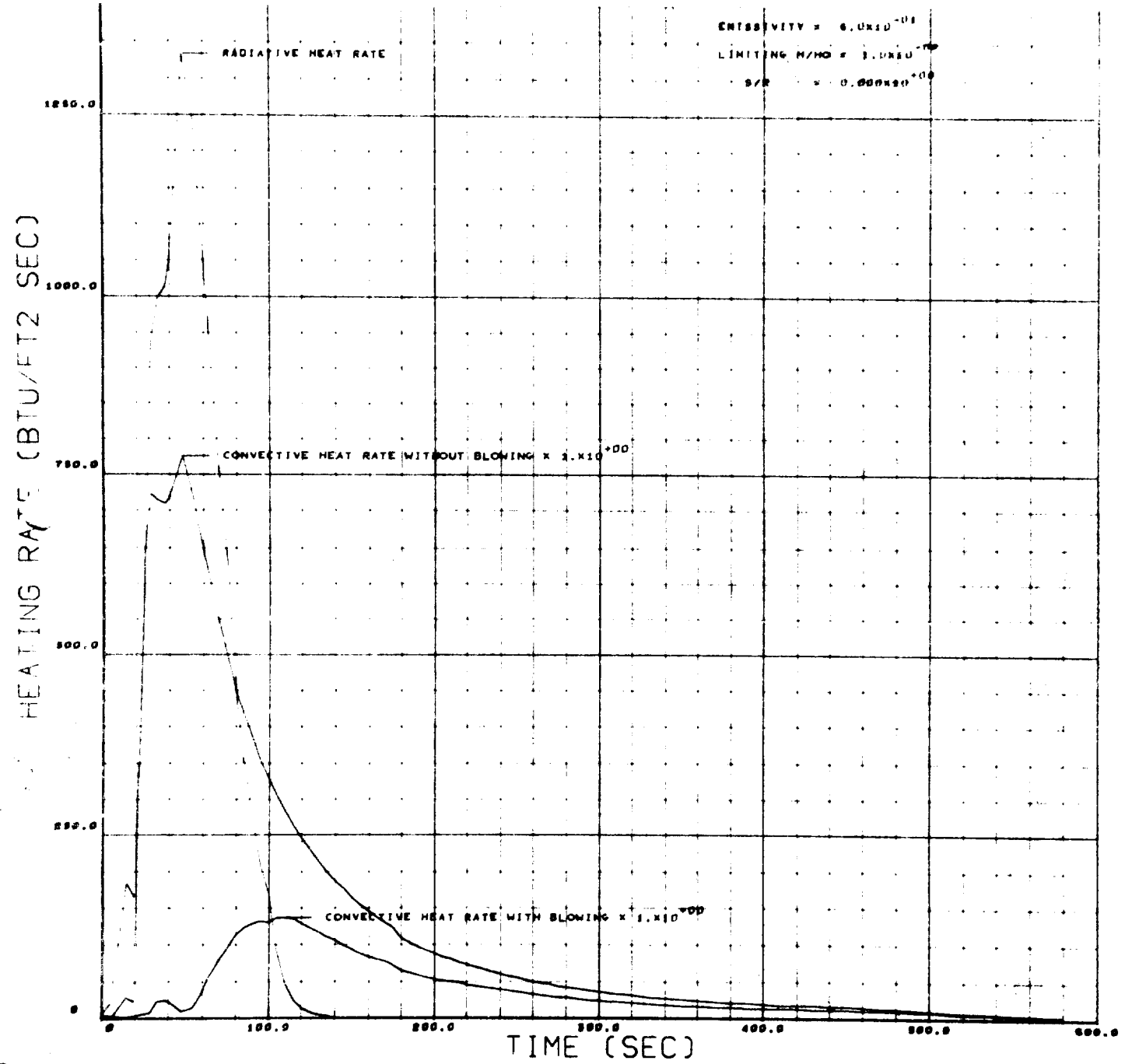


FIGURE A96

MATERIAL RESPONSE DATA

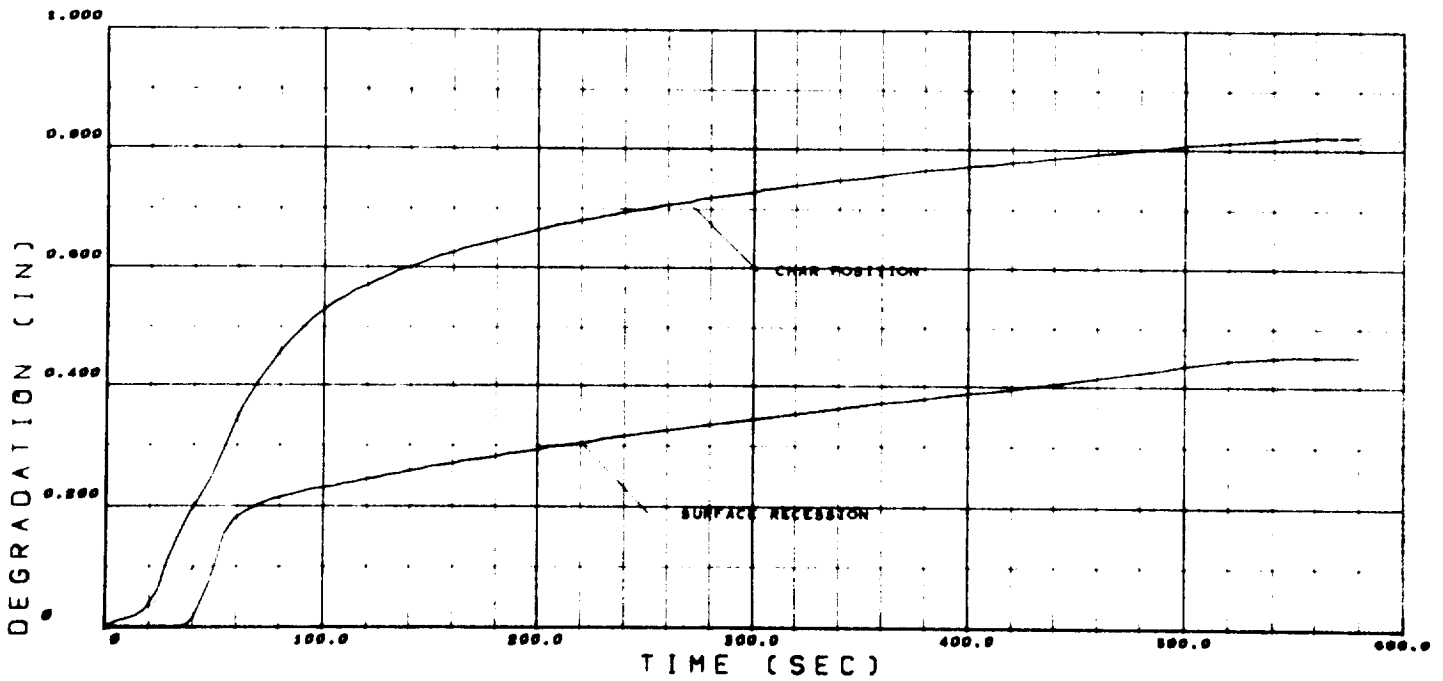
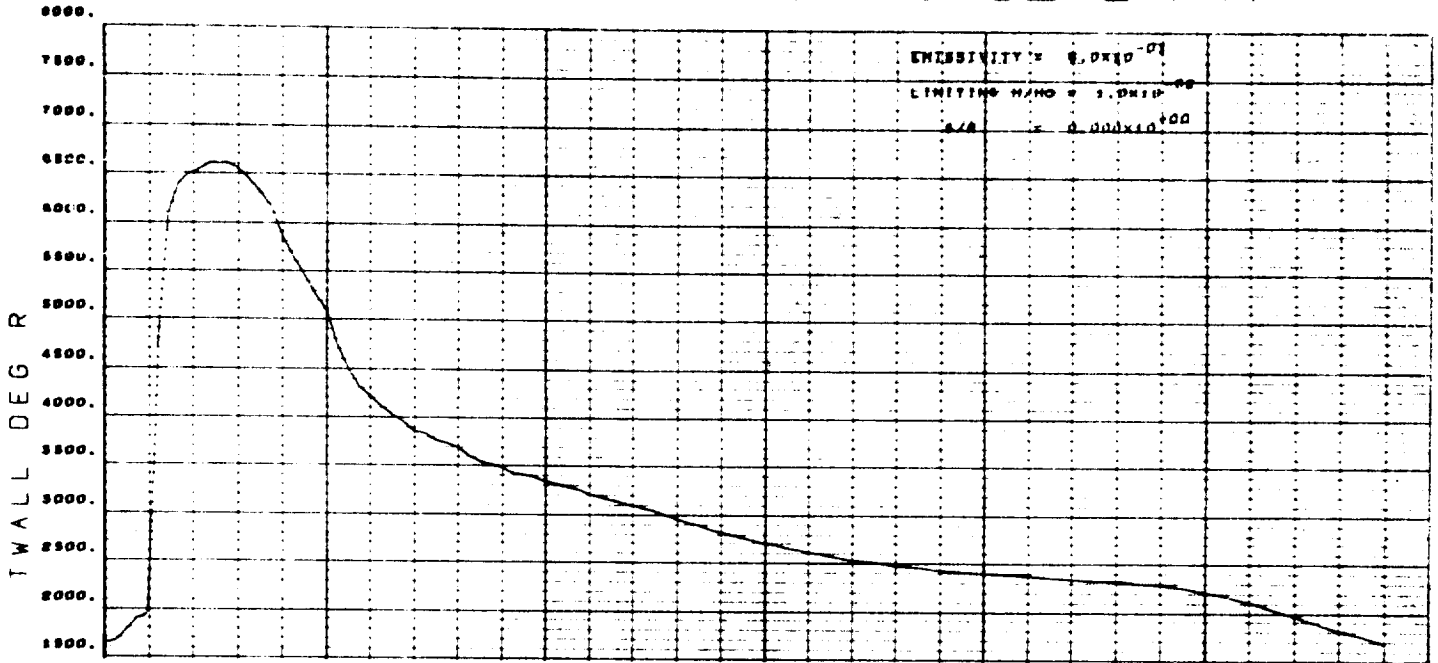


FIGURE A96

ENERGY ACCOMMODATION MECHANISMS

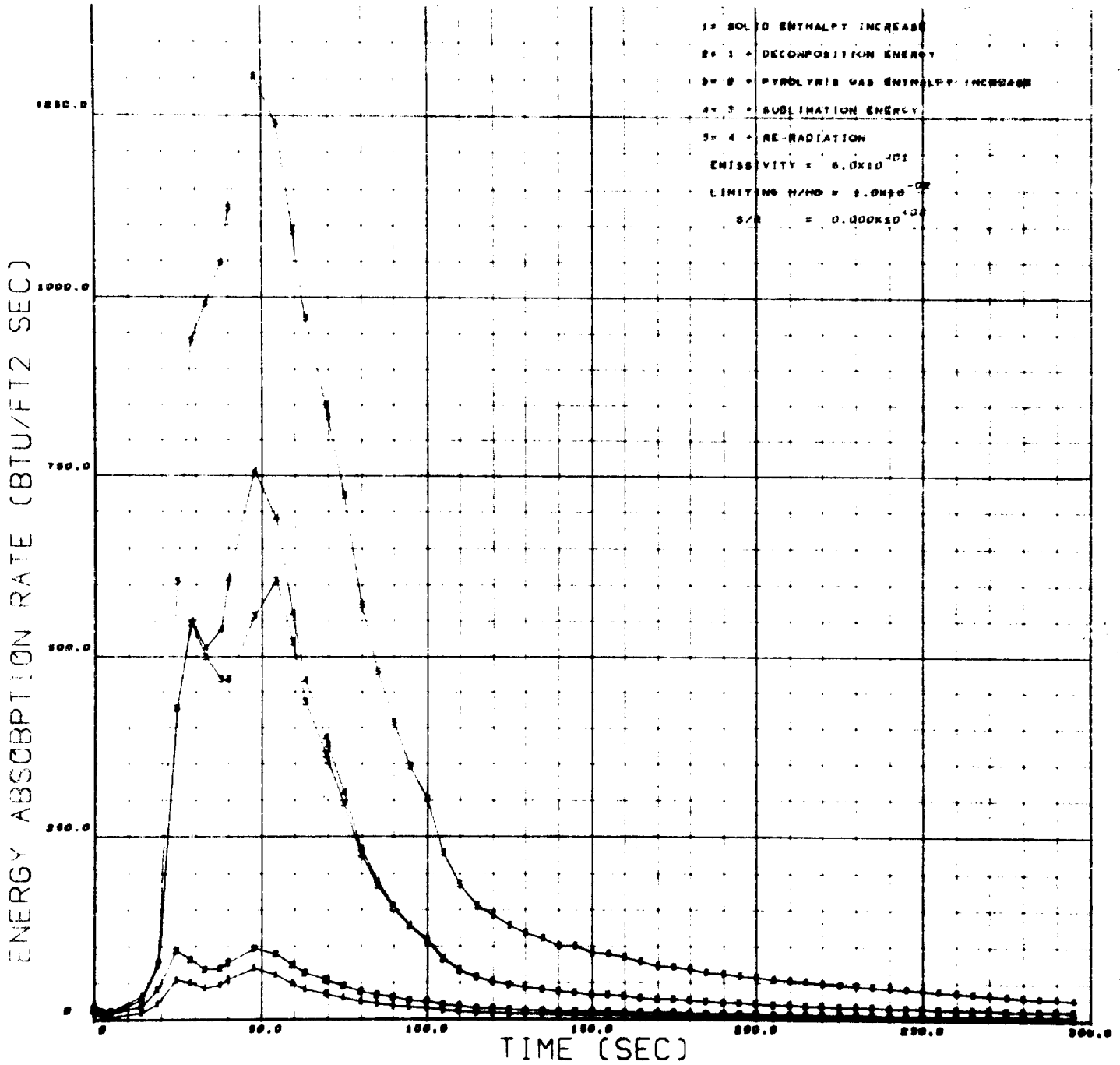


FIGURE A 97

HEATING RATE HISTORY

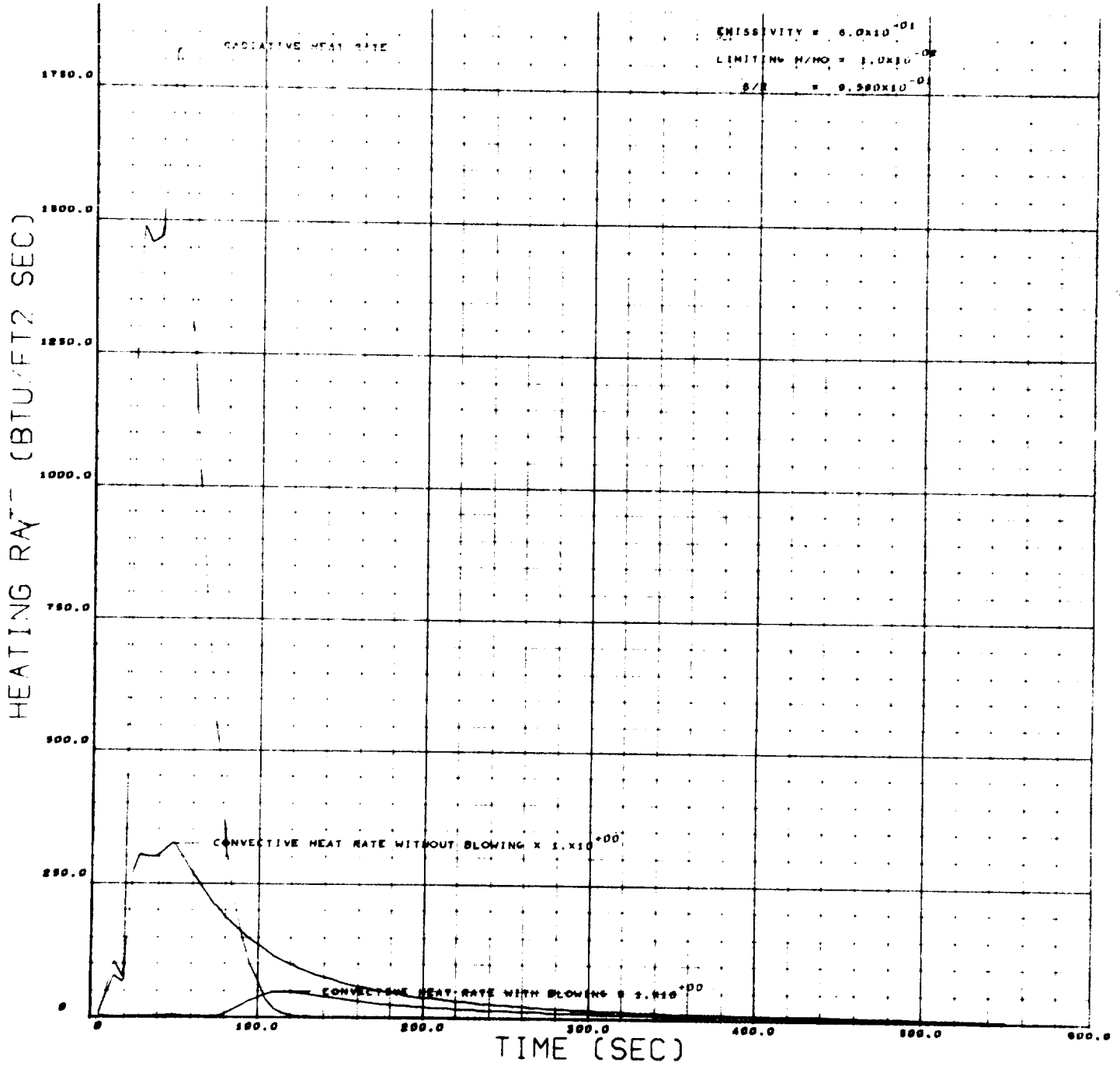


FIGURE A 97

MATERIAL RESPONSE DATA

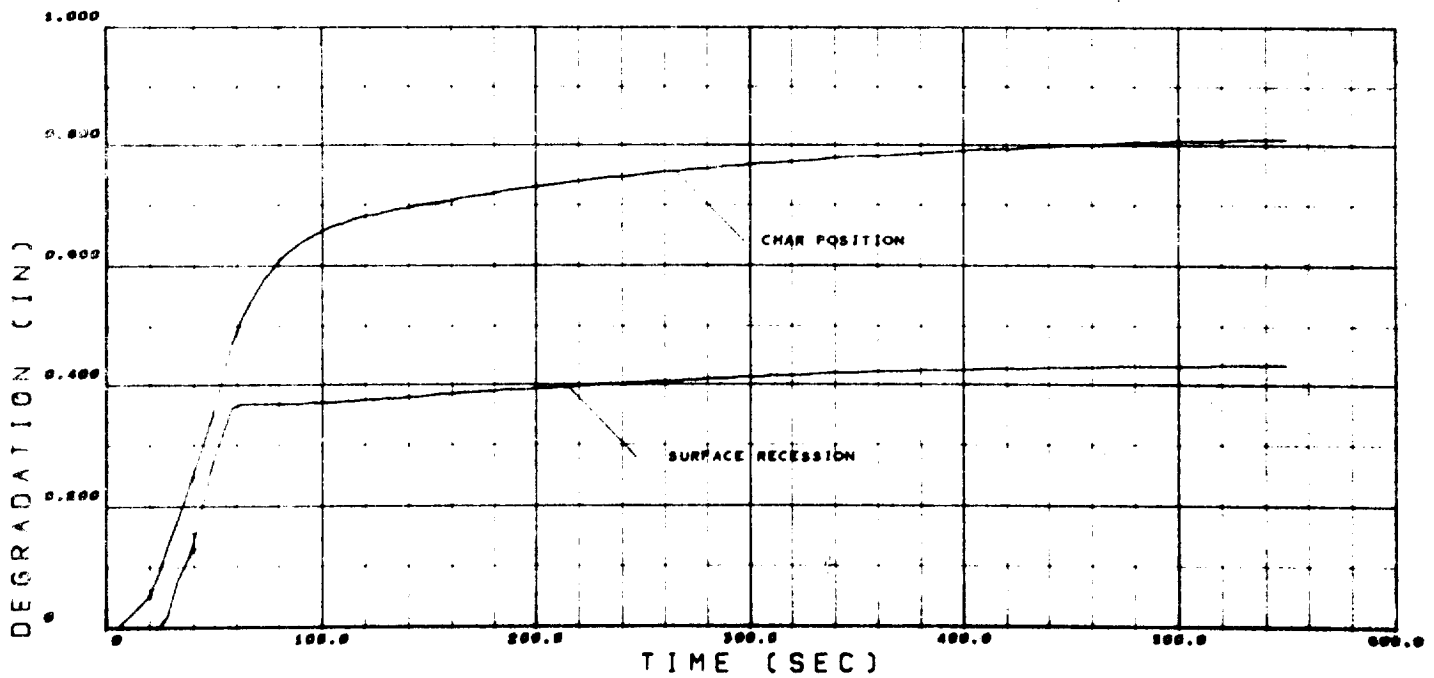
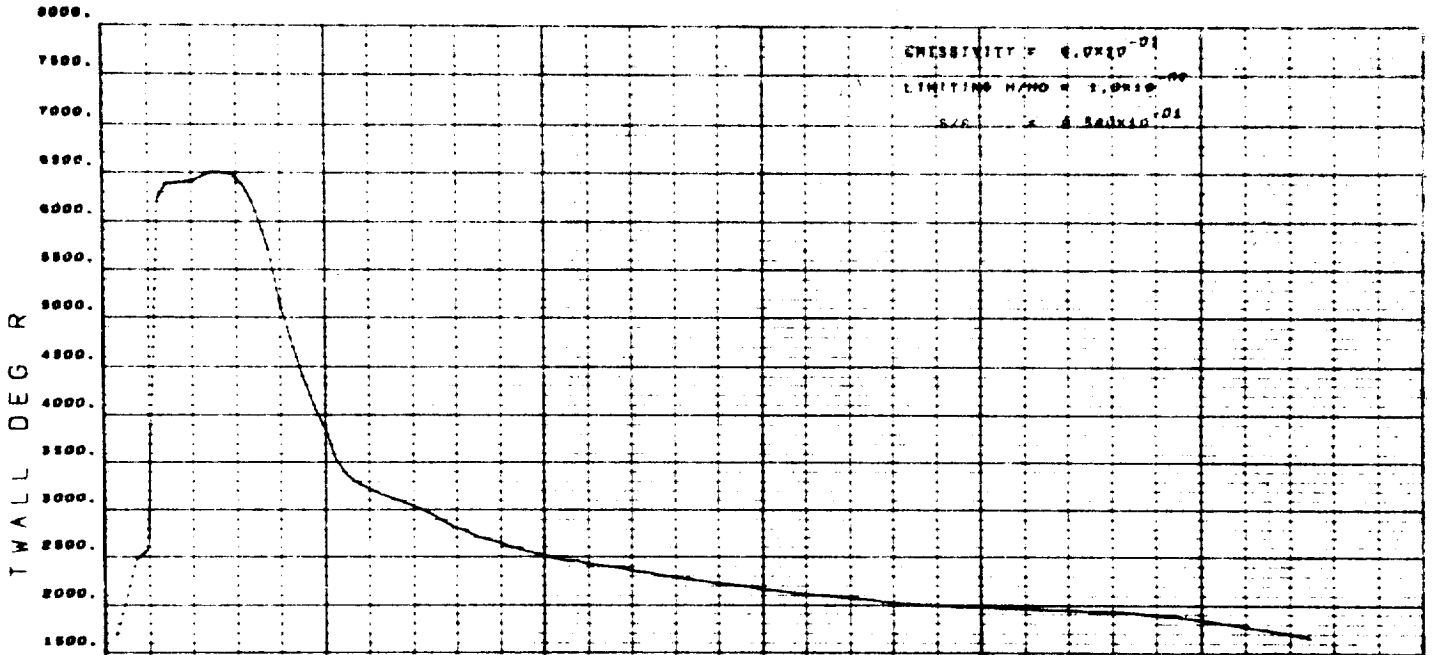


FIGURE A97

ENERGY ACCOMMODATION MECHANISMS

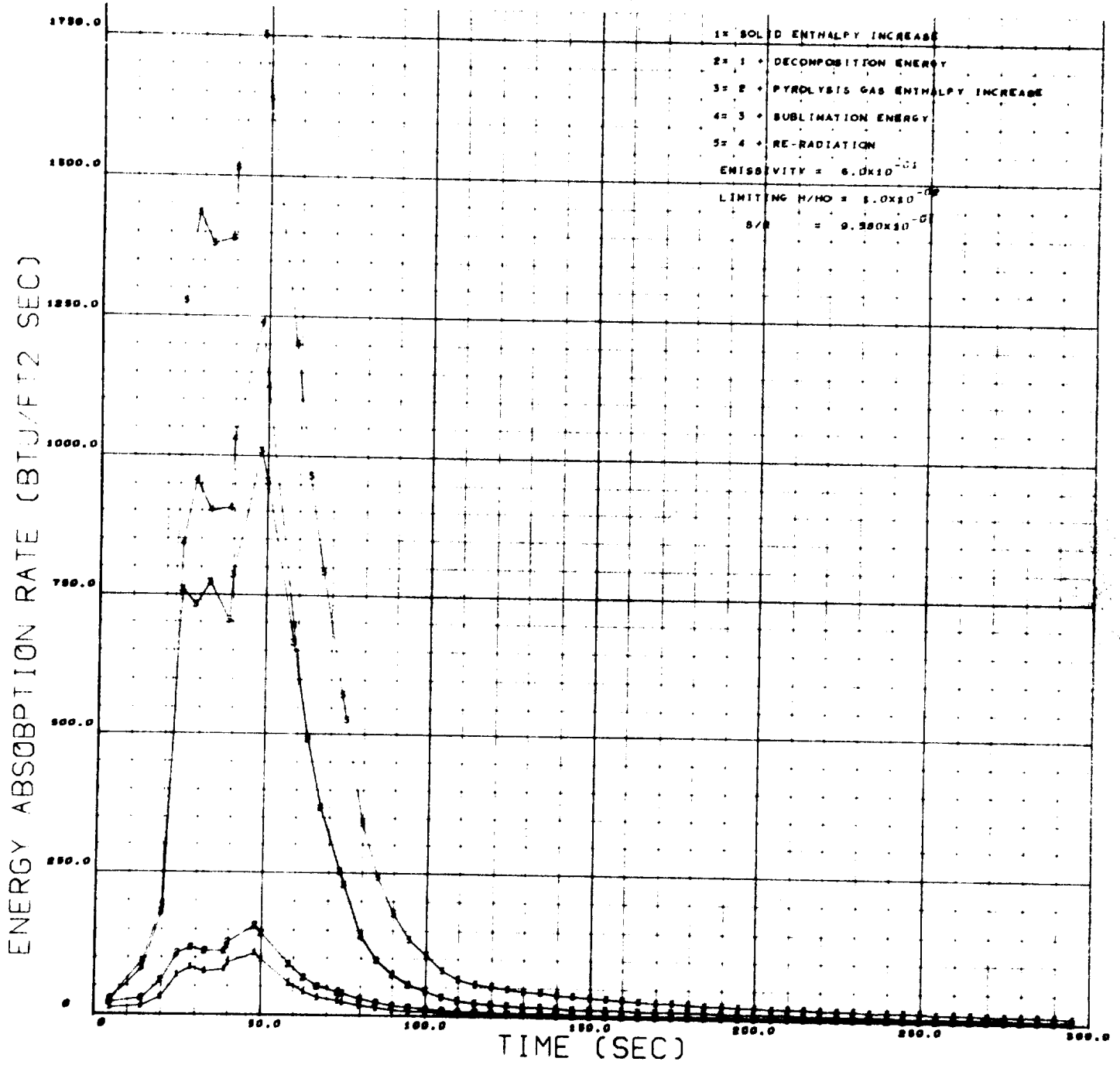


FIGURE A 98

HEATING RATE HISTORY

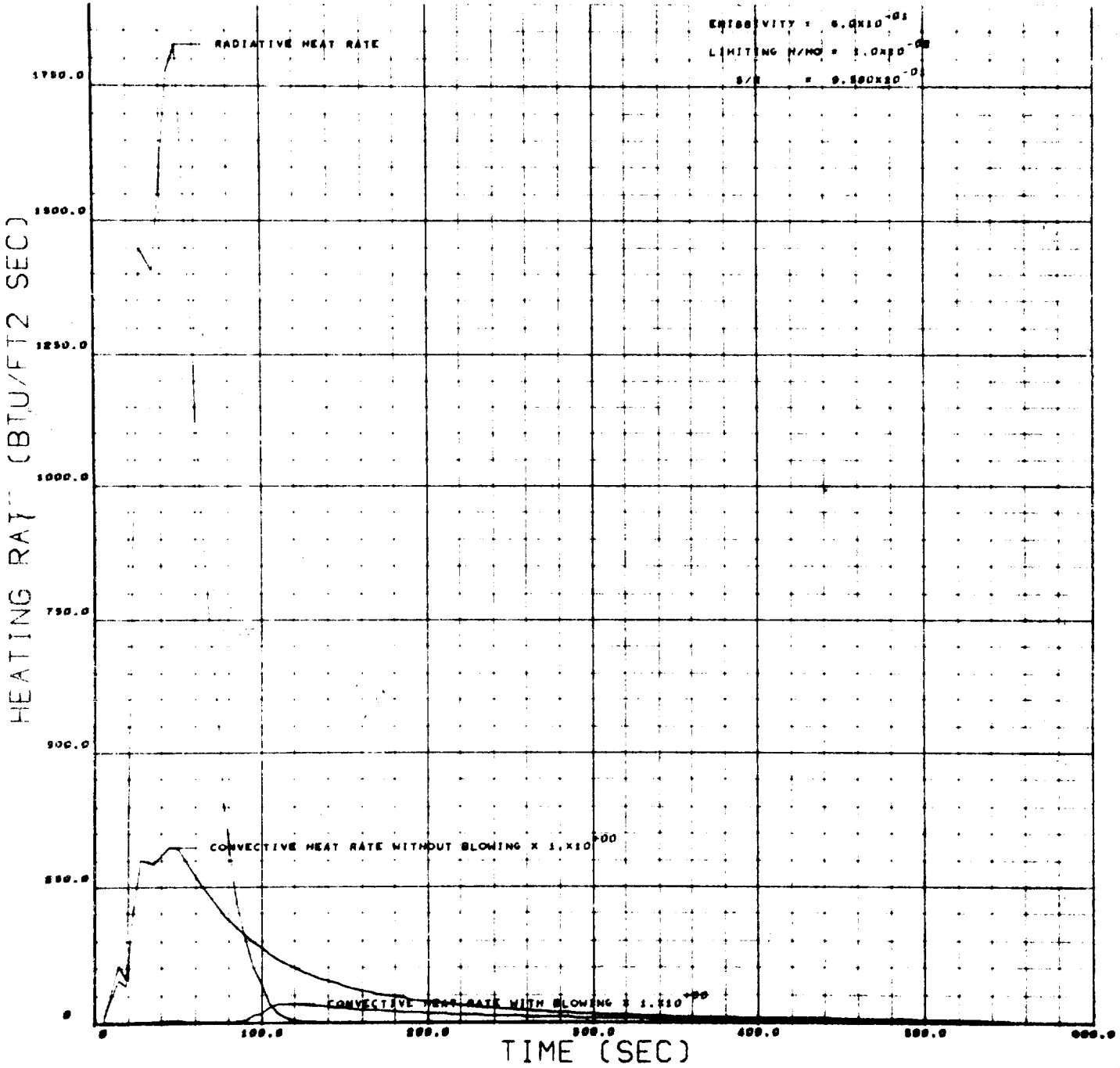


FIGURE A 98

MATERIAL RESPONSE DATA

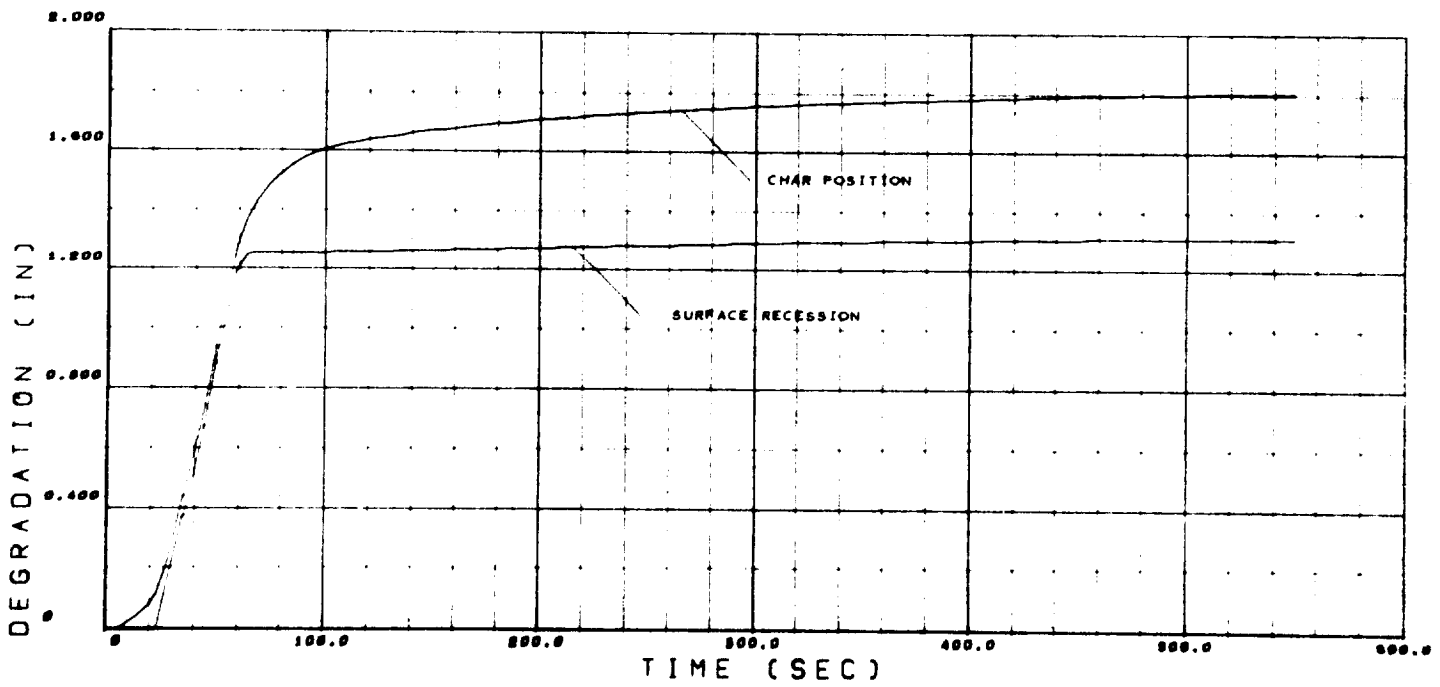
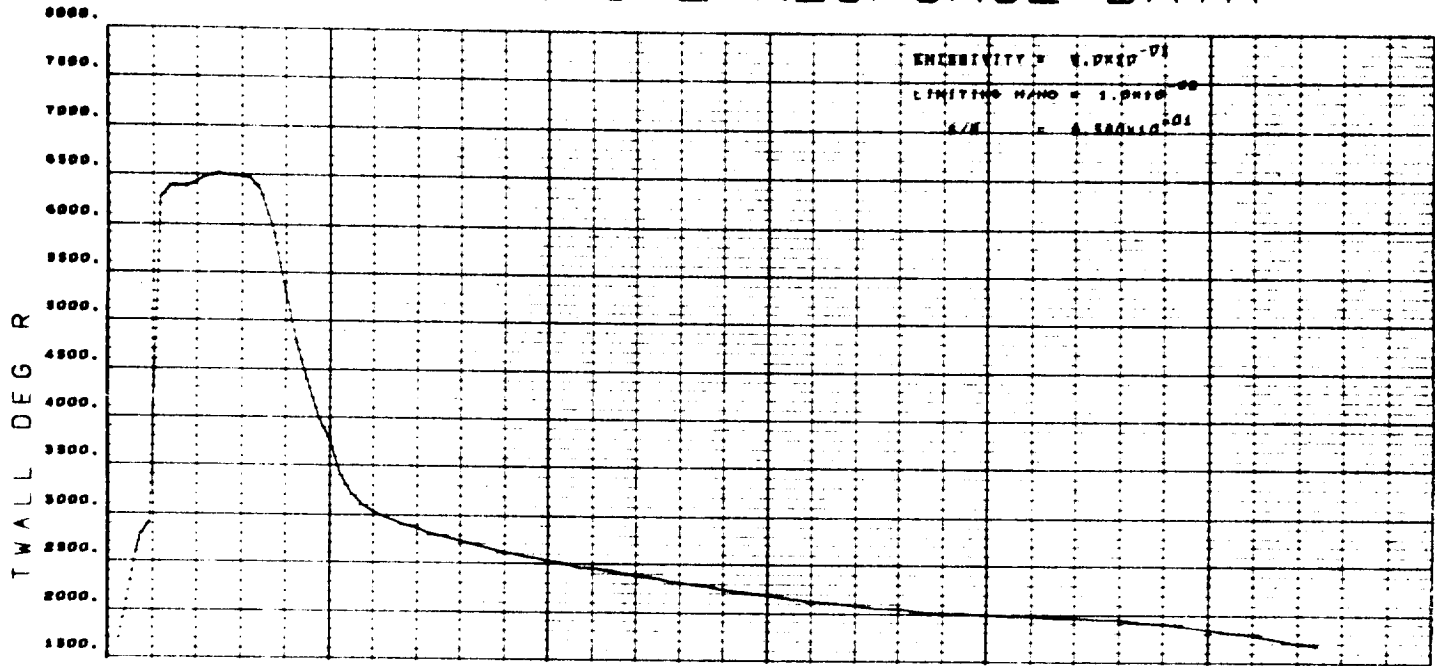


FIGURE A98

ENERGY ACCOMMODATION MECHANISMS

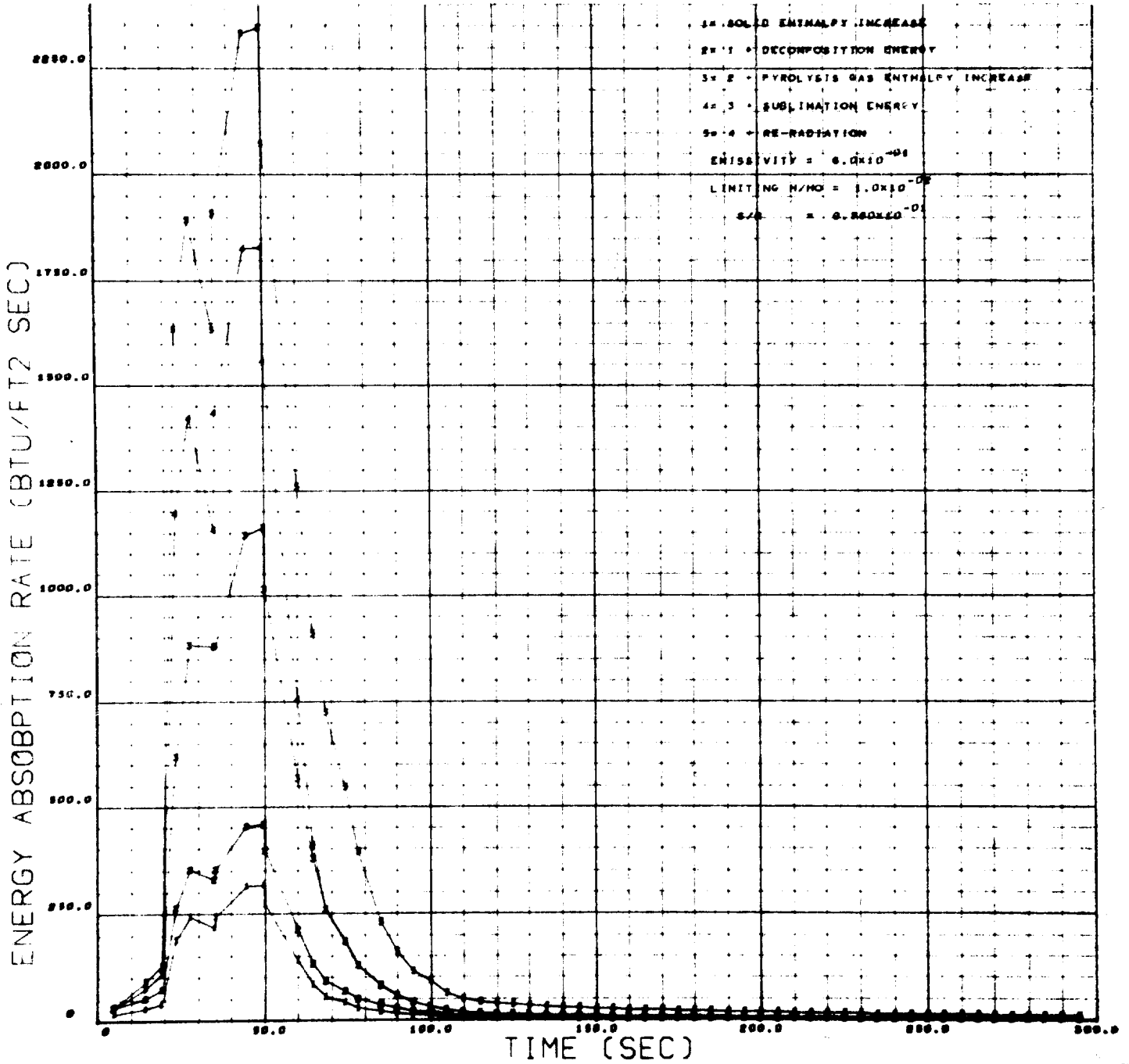


FIGURE A 99

HEATING RATE HISTORY

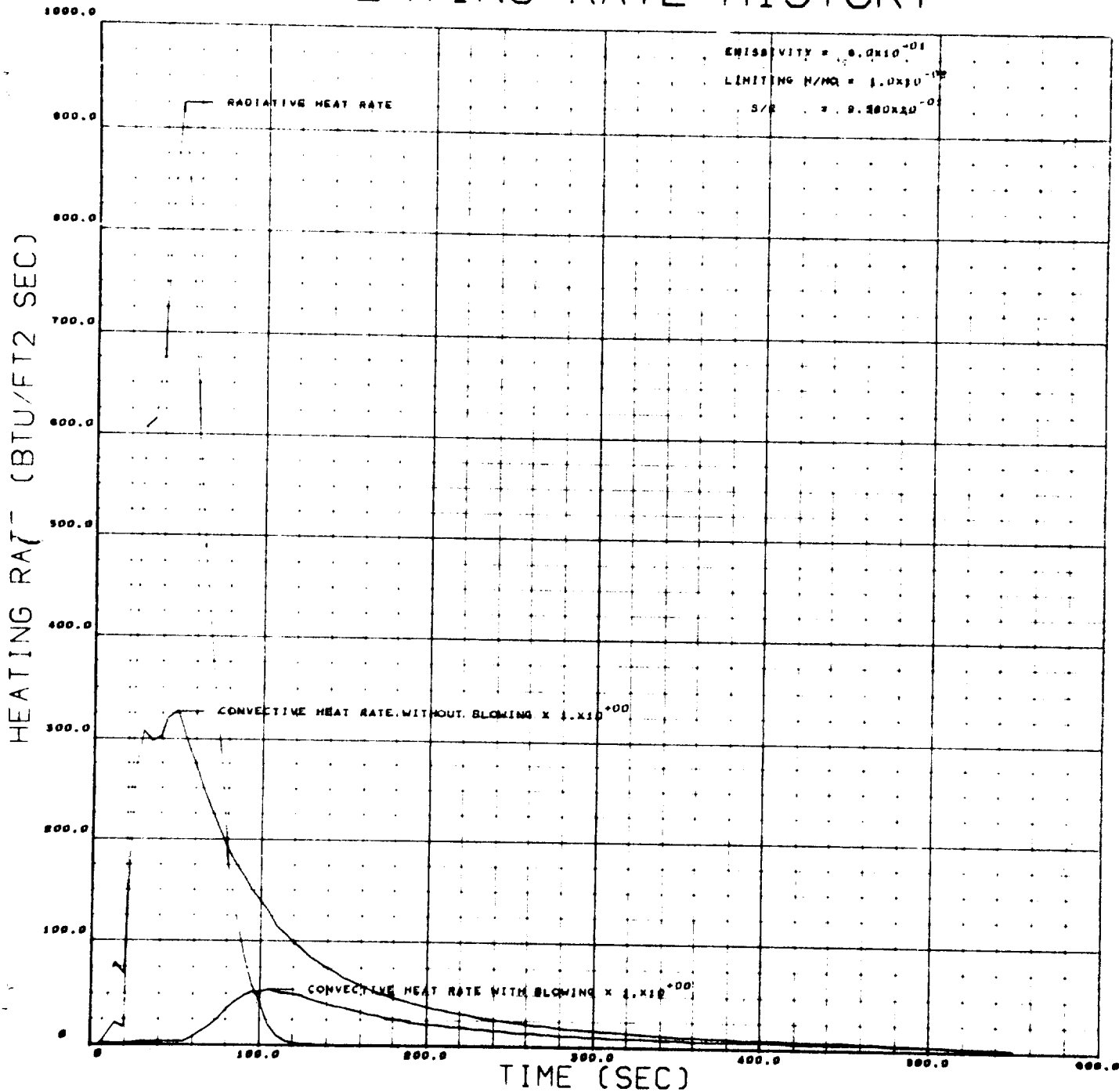


FIGURE A 99

MATERIAL RESPONSE DATA

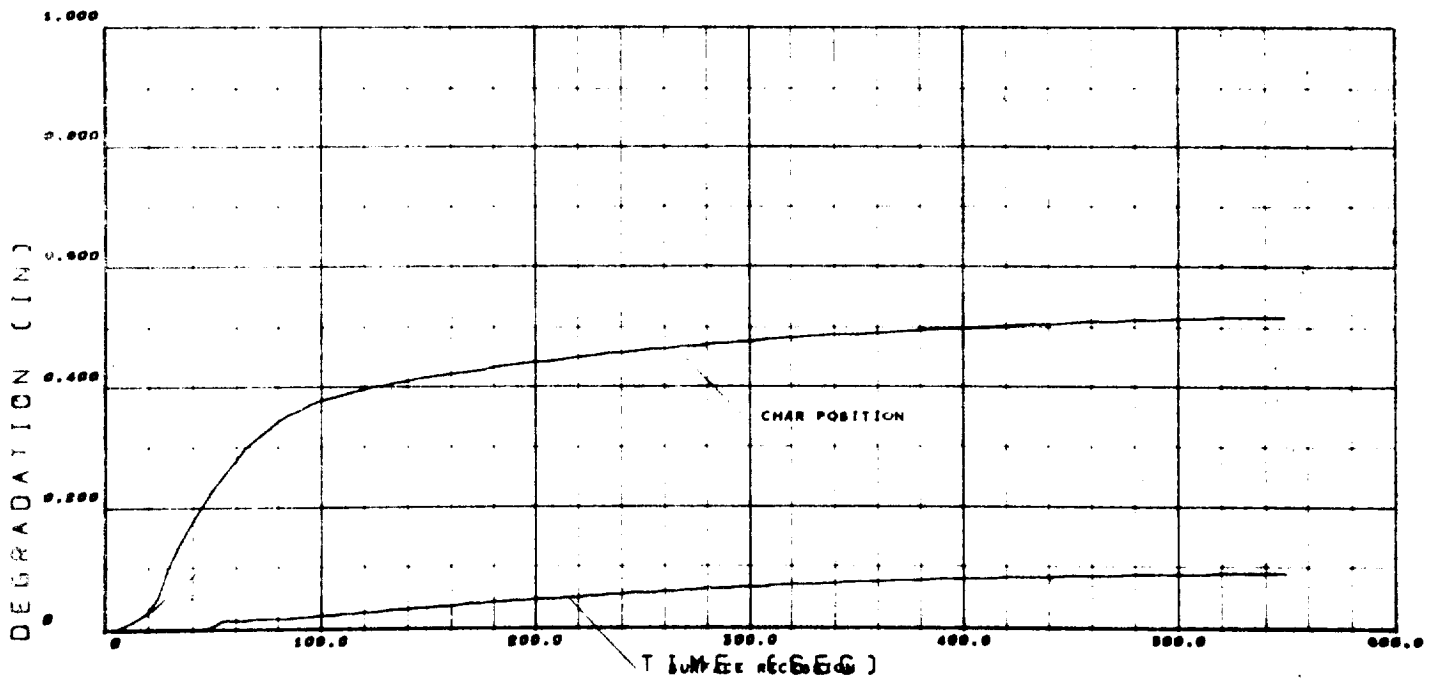
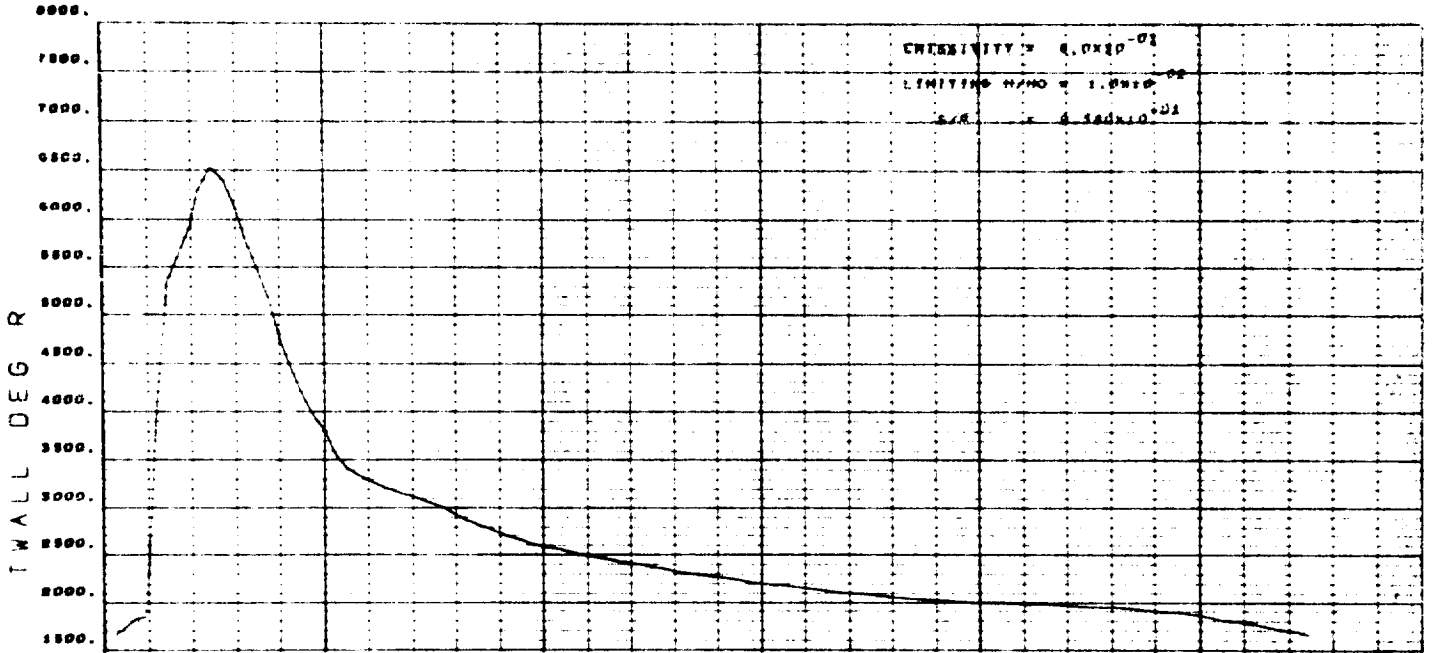


FIGURE A99

ENERGY ACCOMMODATION MECHANISMS

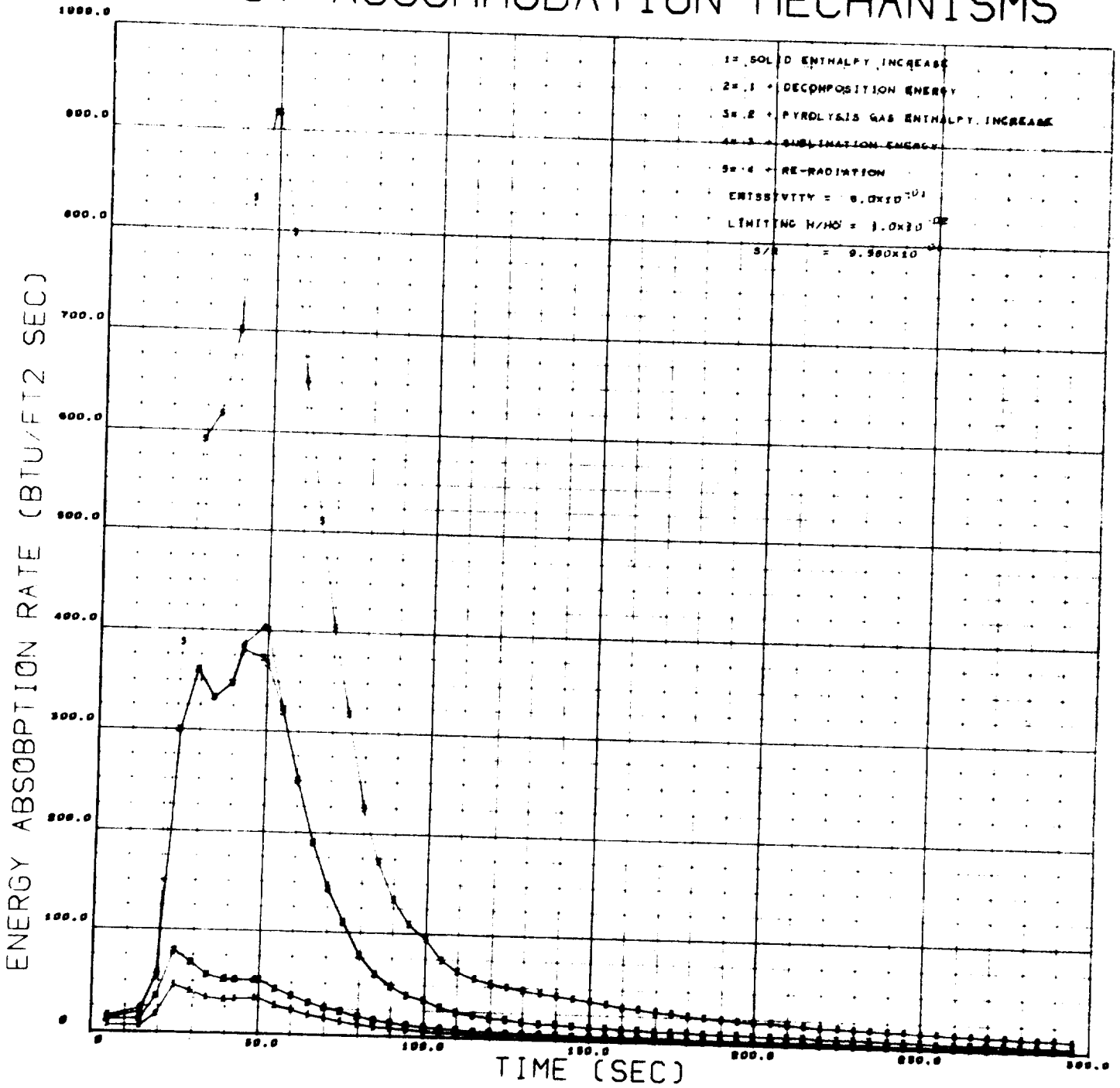


FIGURE A100

HEATING RATE HISTORY

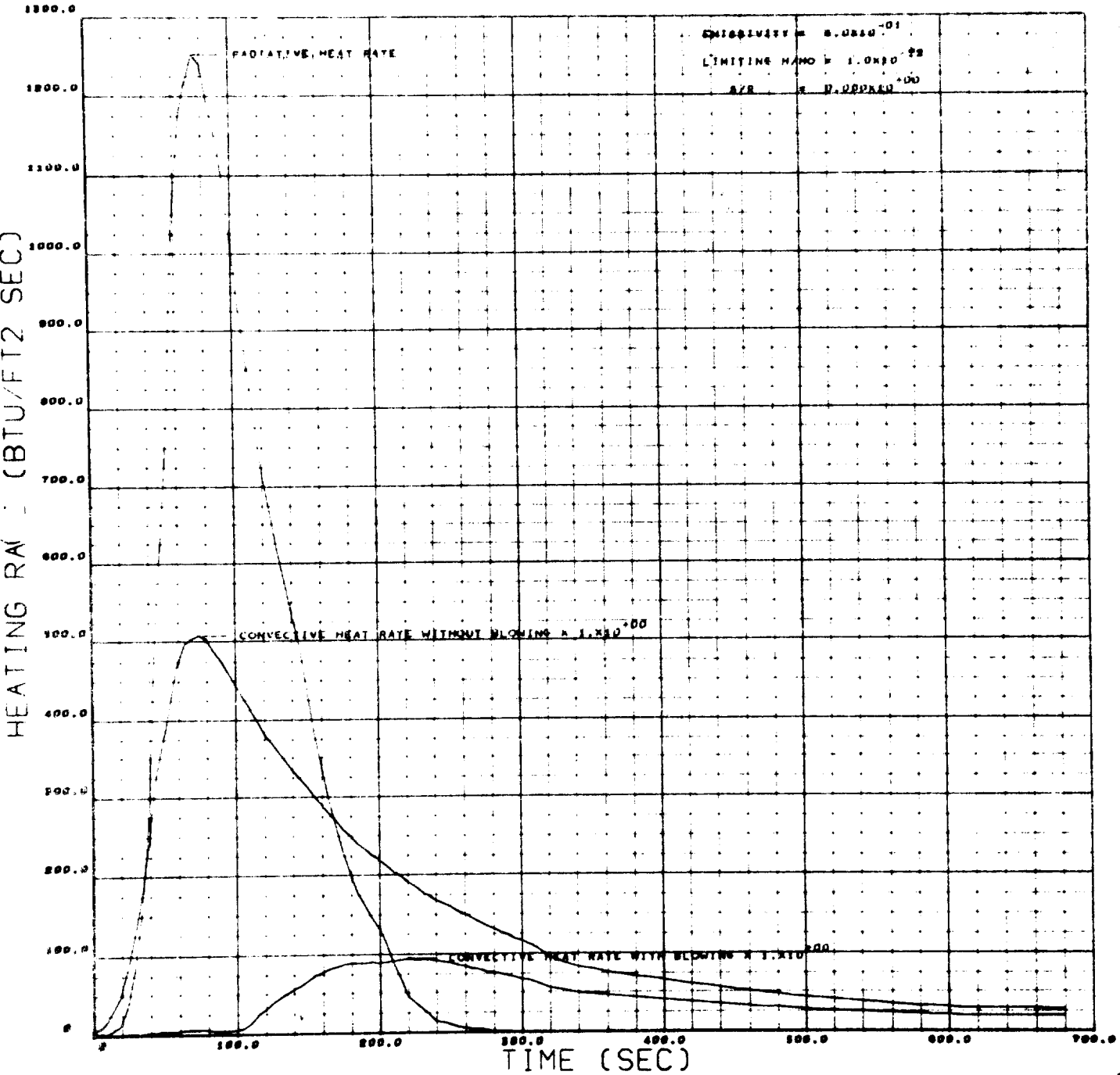


FIGURE A100

MATERIAL RESPONSE DATA

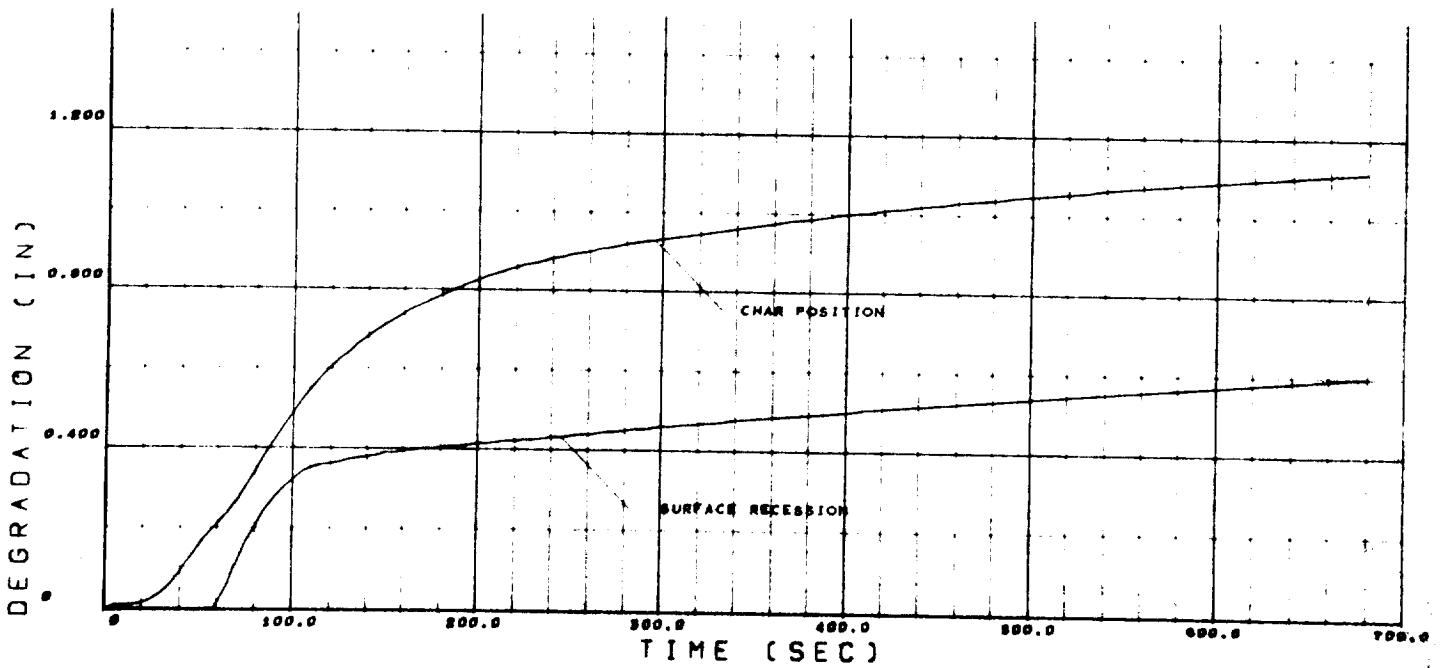
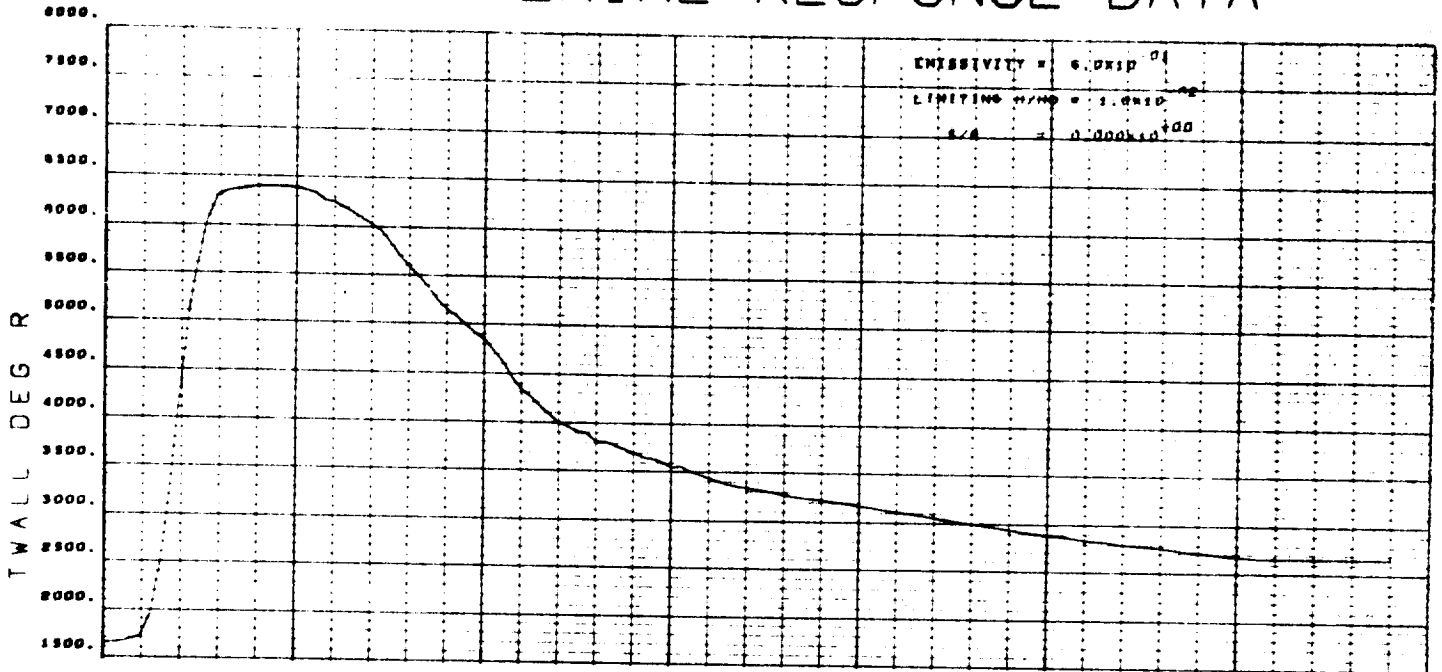


FIGURE A100

ENERGY ACCOMMODATION MECHANISMS

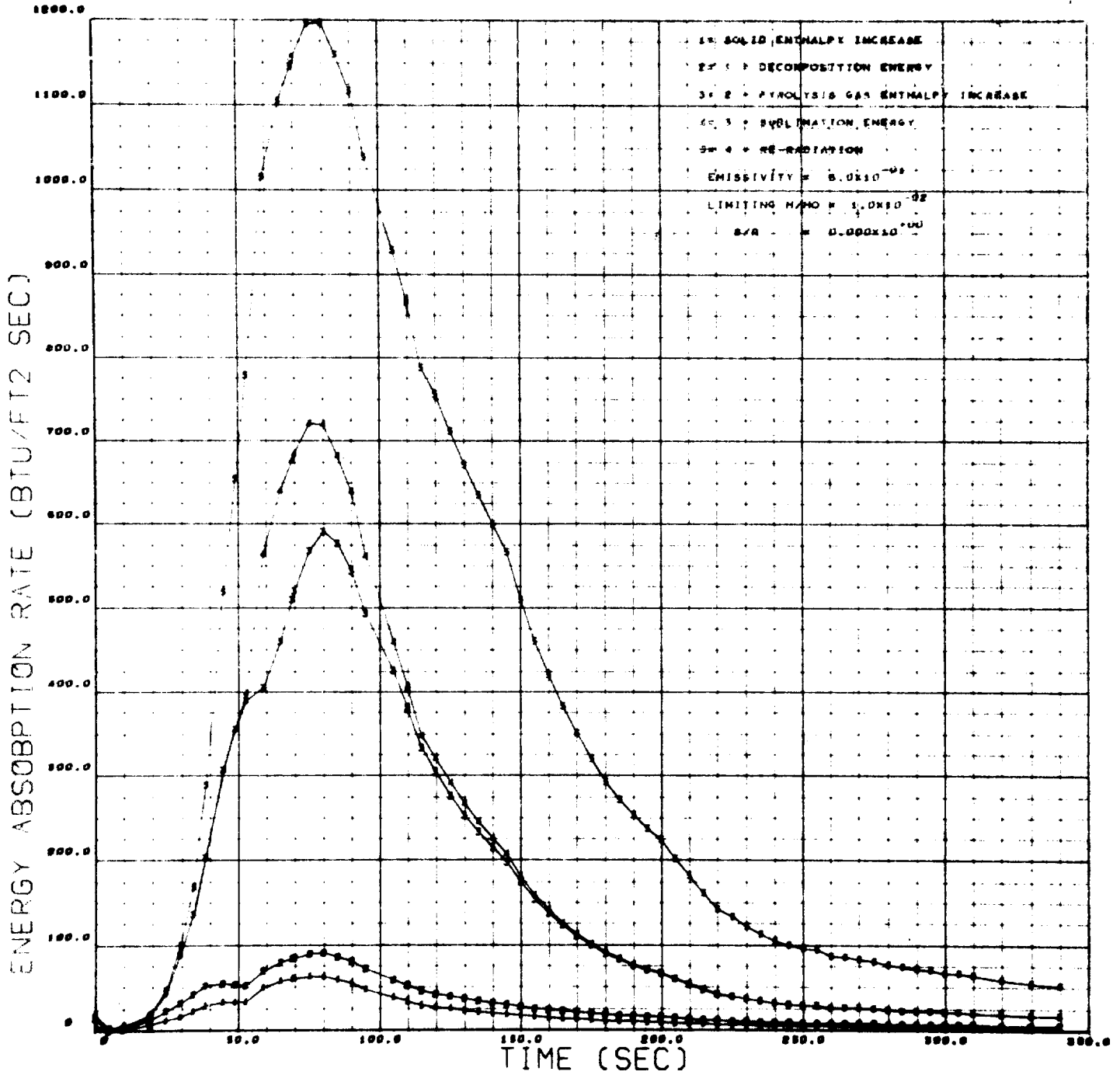


FIGURE A101

HEATING RATE HISTORY

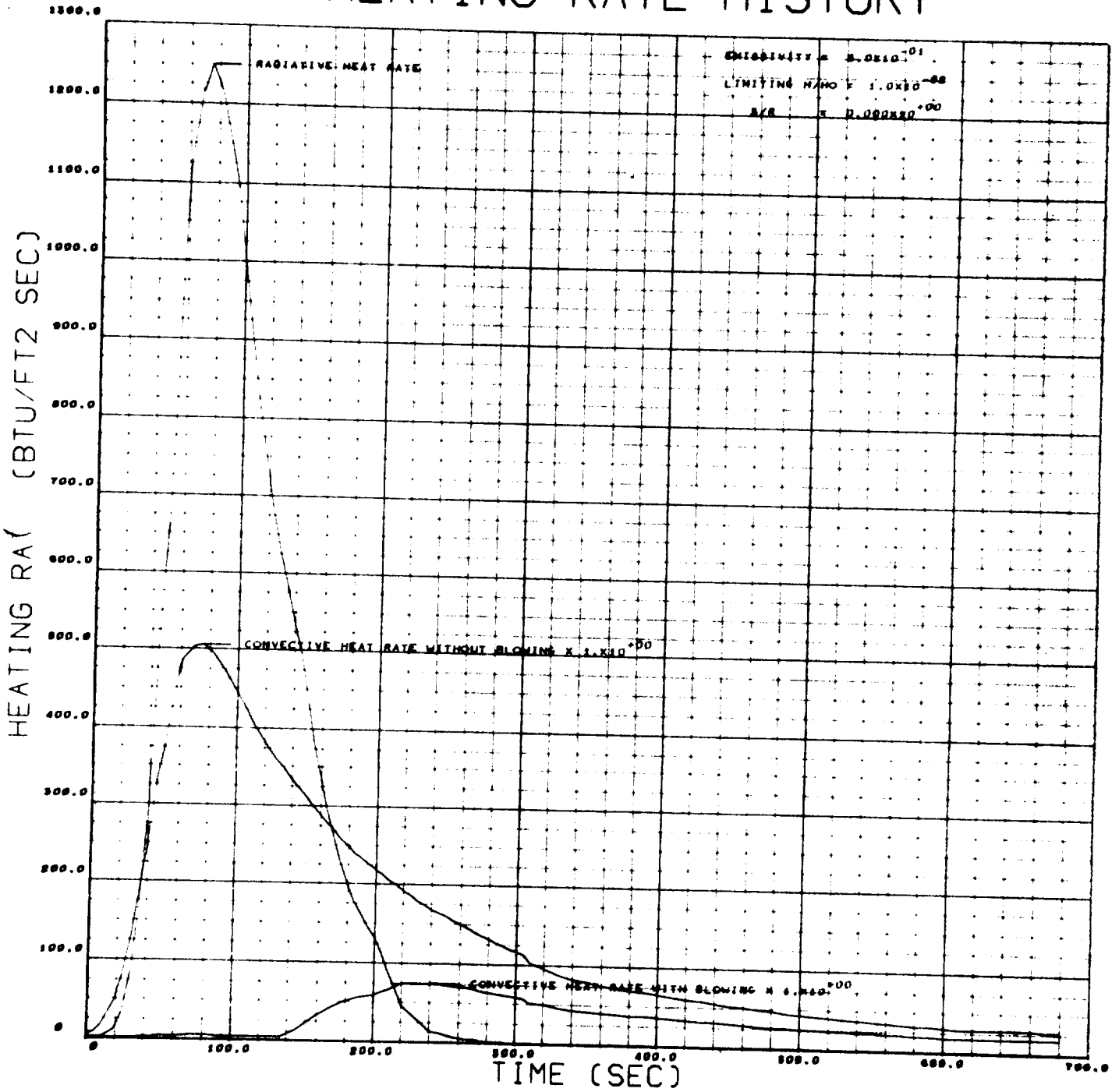


FIGURE A101

MATERIAL RESPONSE DATA

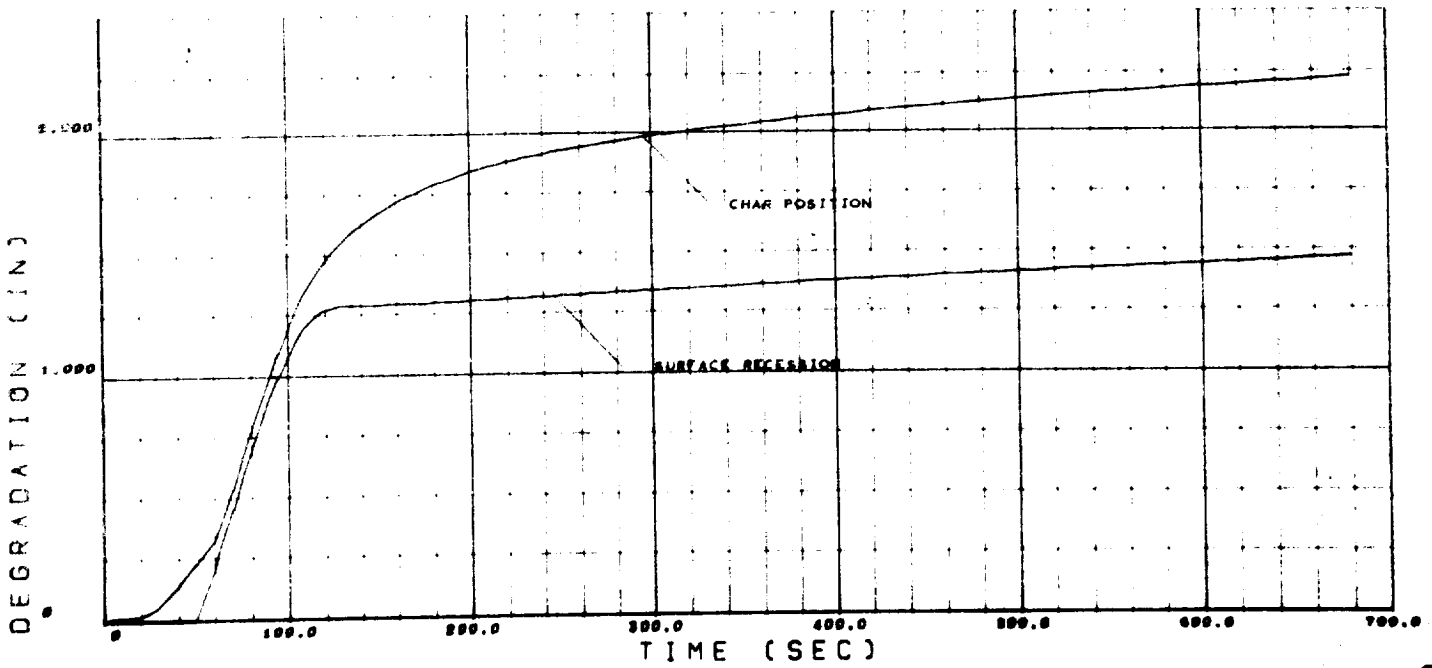
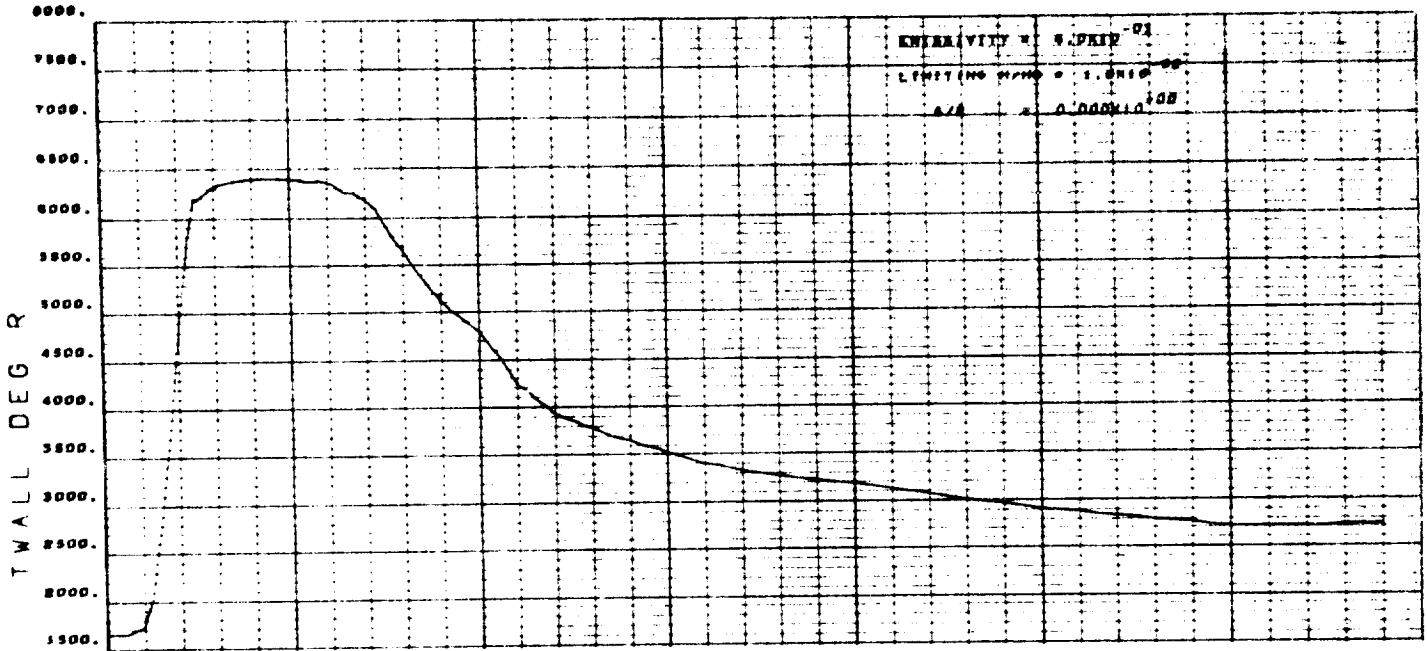


FIGURE A101

ENERGY ACCOMMODATION MECHANISMS

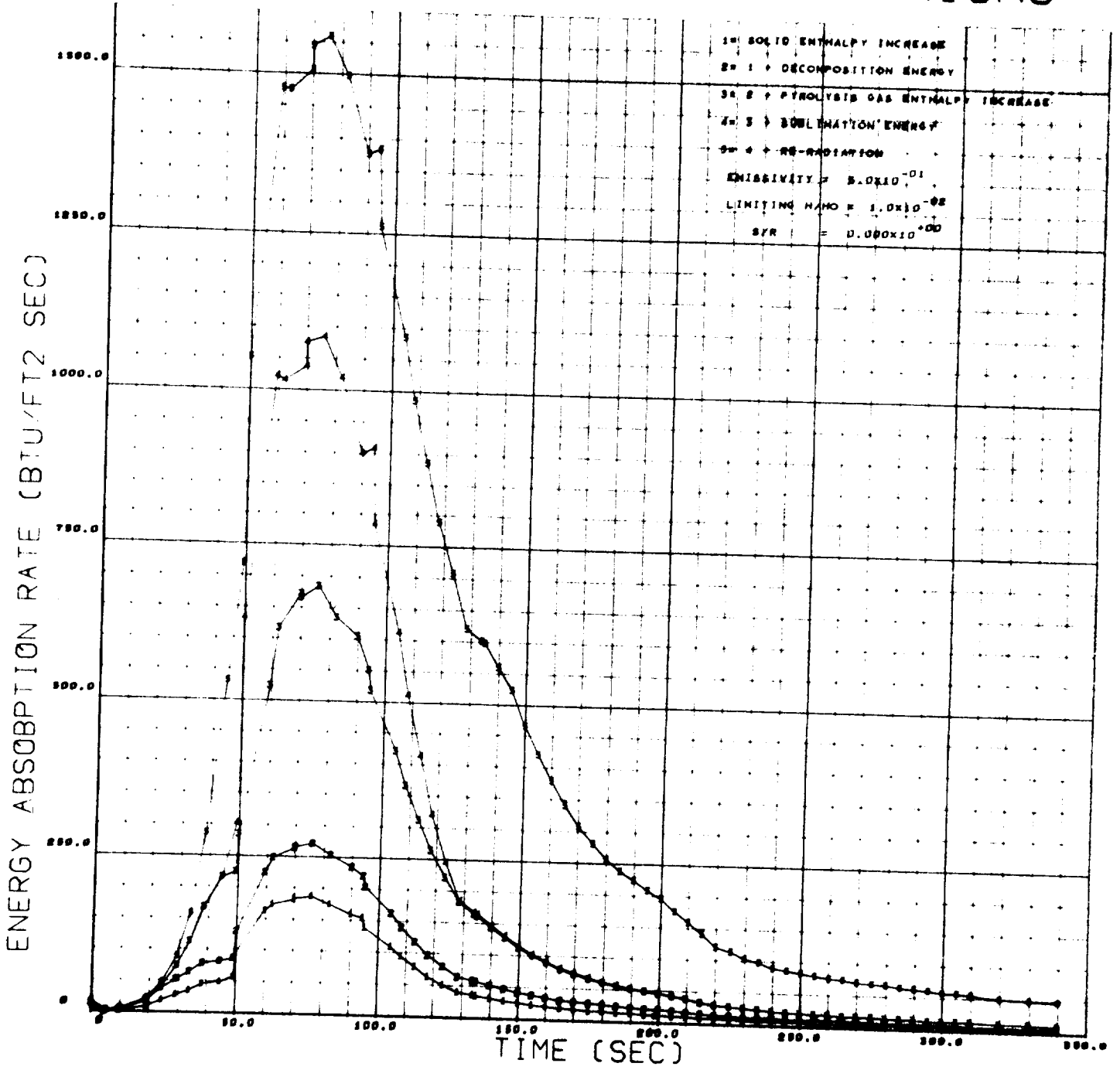


FIGURE A102

HEATING RATE HISTORY

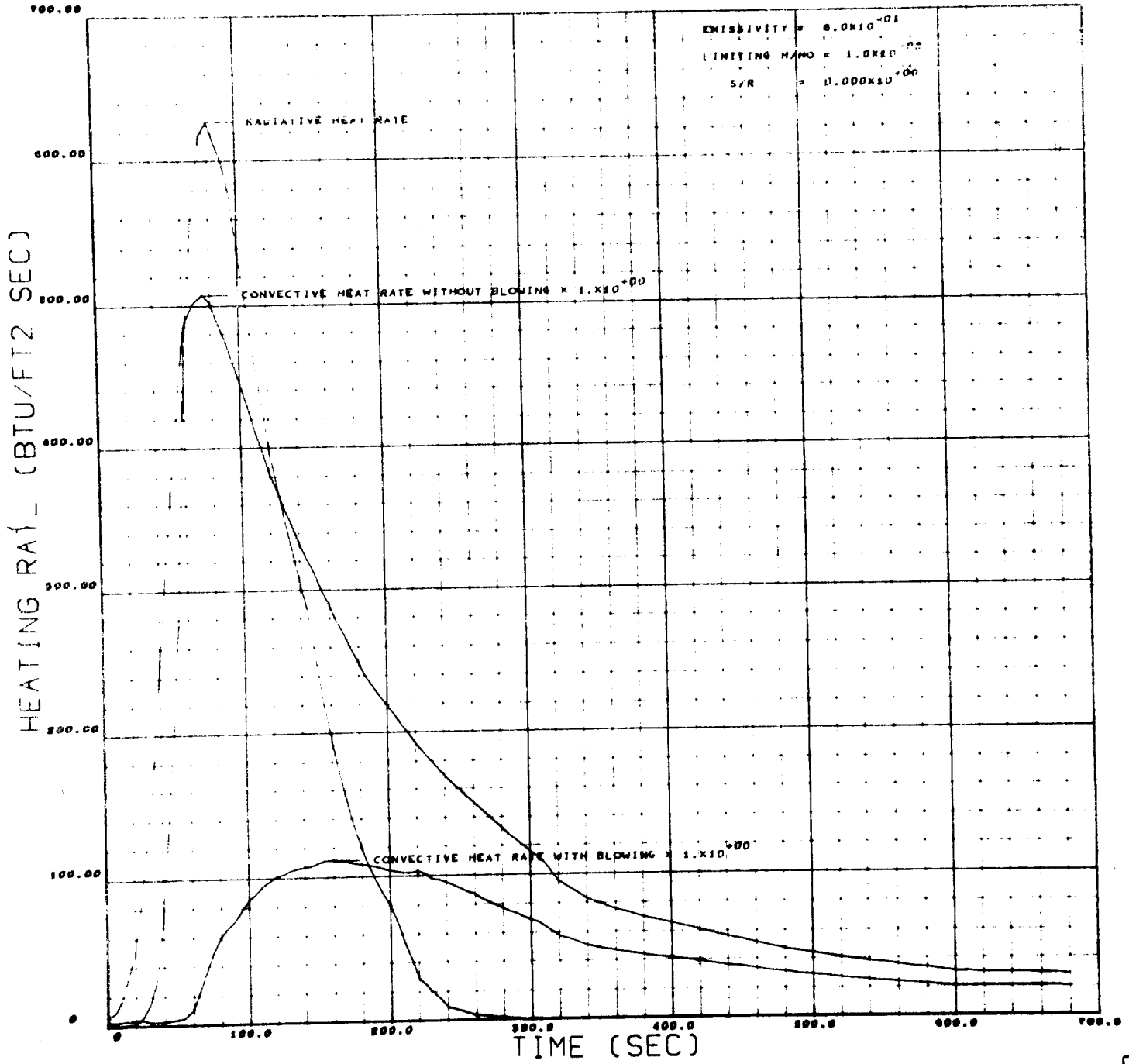


FIGURE A102

MATERIAL RESPONSE DATA

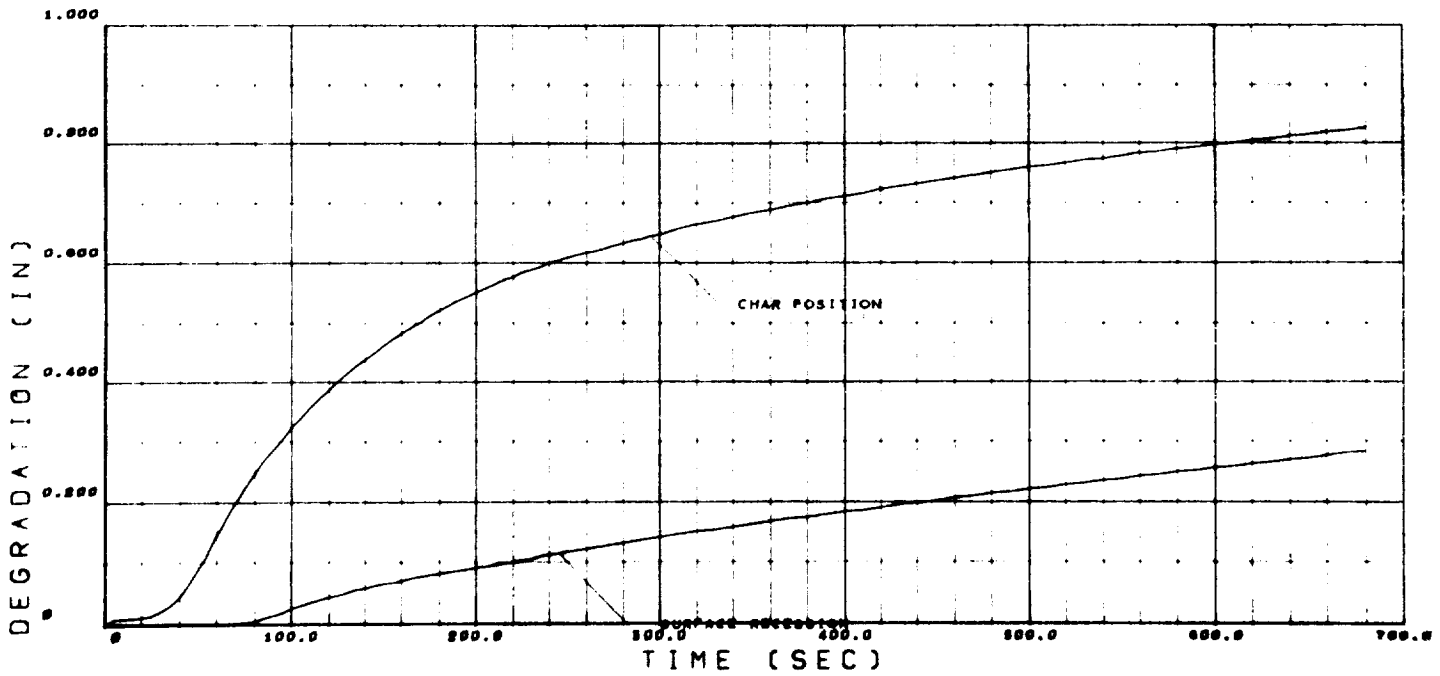
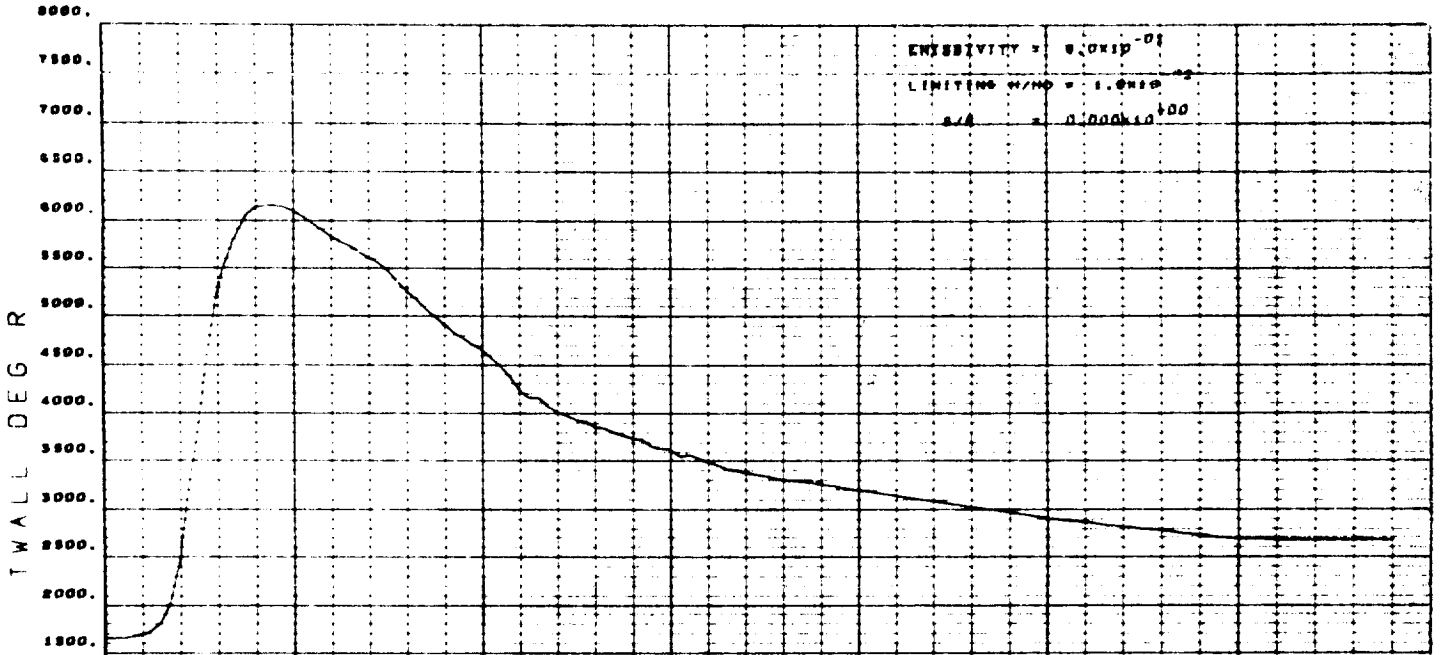


FIGURE A102

ENERGY ACCOMMODATION MECHANISMS

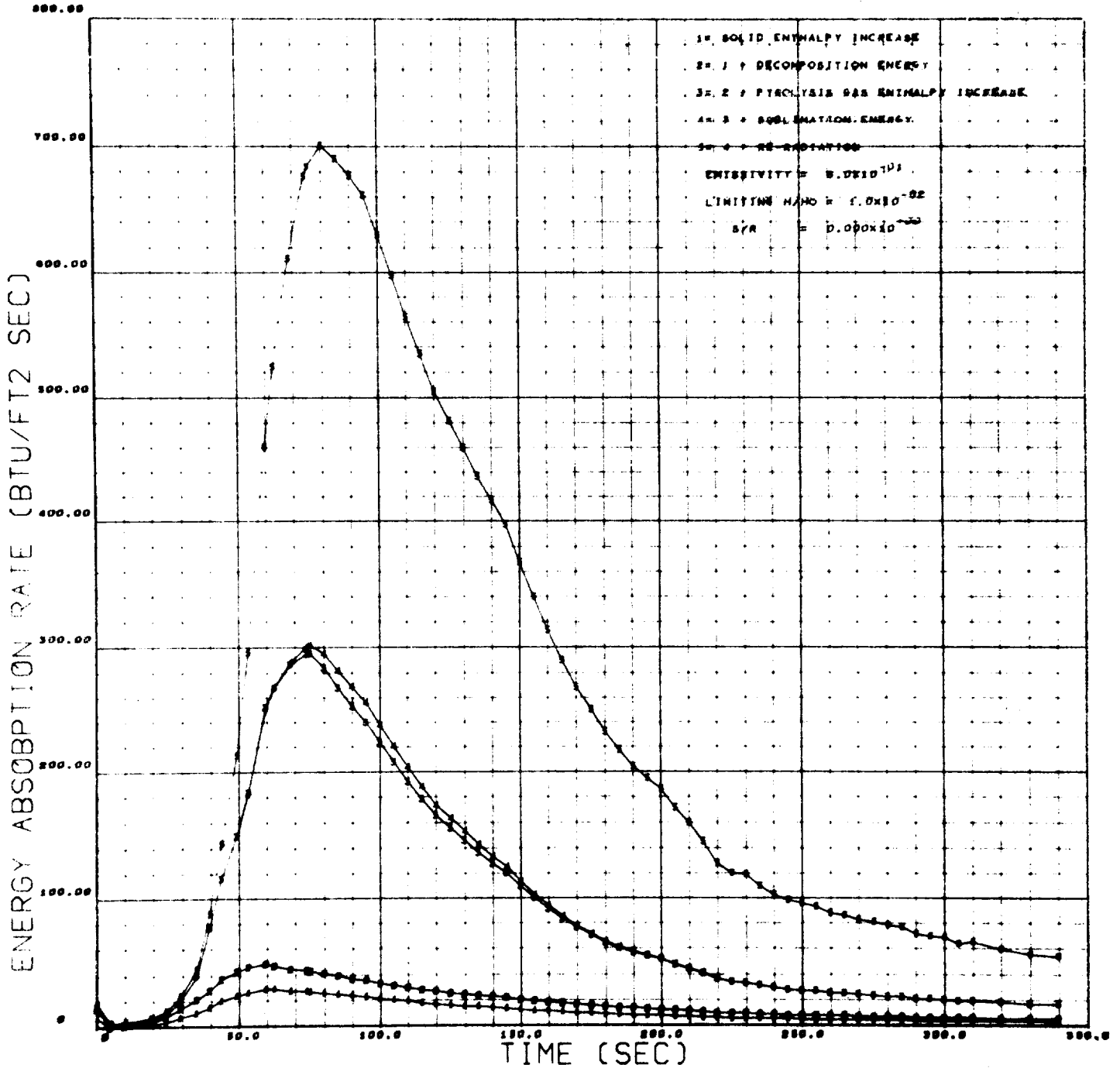


FIGURE A103

HEATING RATE HISTORY

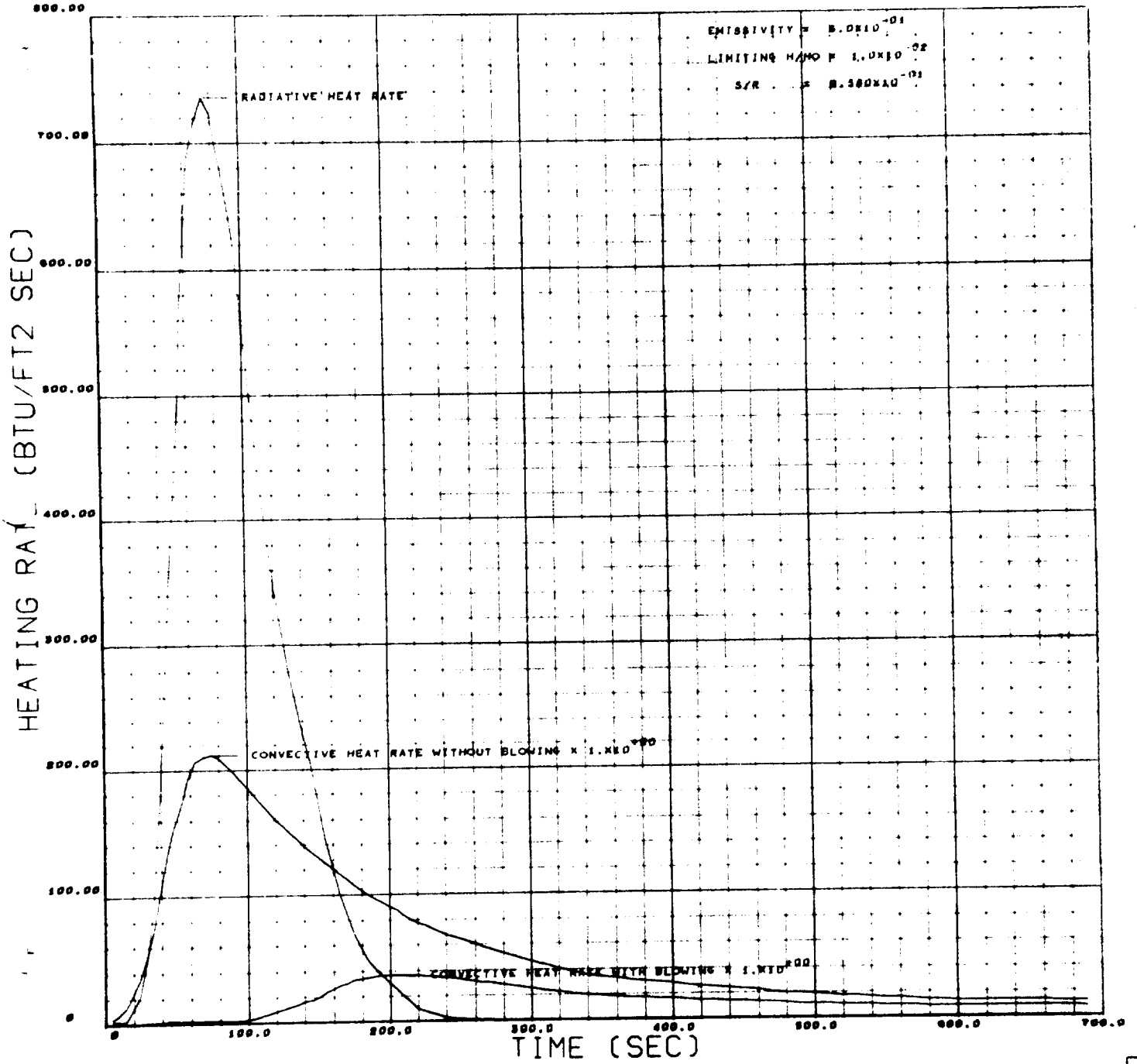


FIGURE A103

MATERIAL RESPONSE DATA

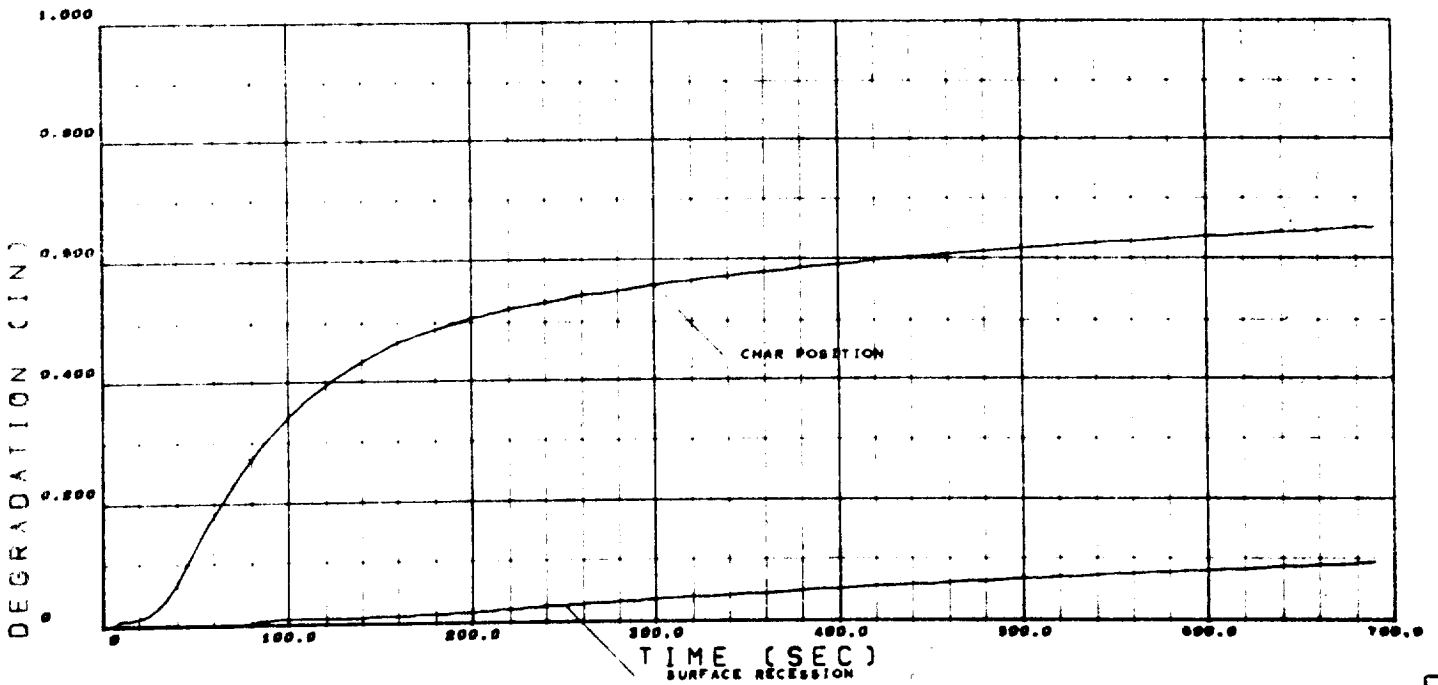
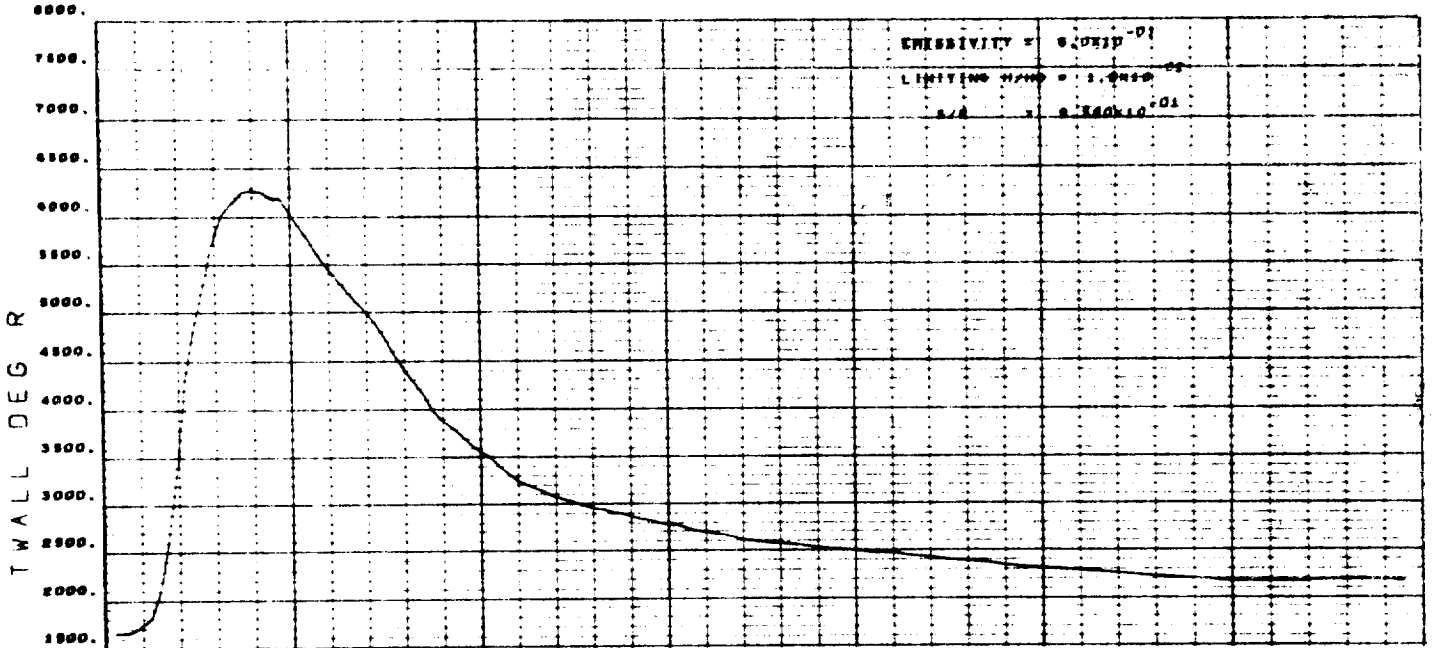


FIGURE A103

ENERGY ACCOMMODATION MECHANISMS

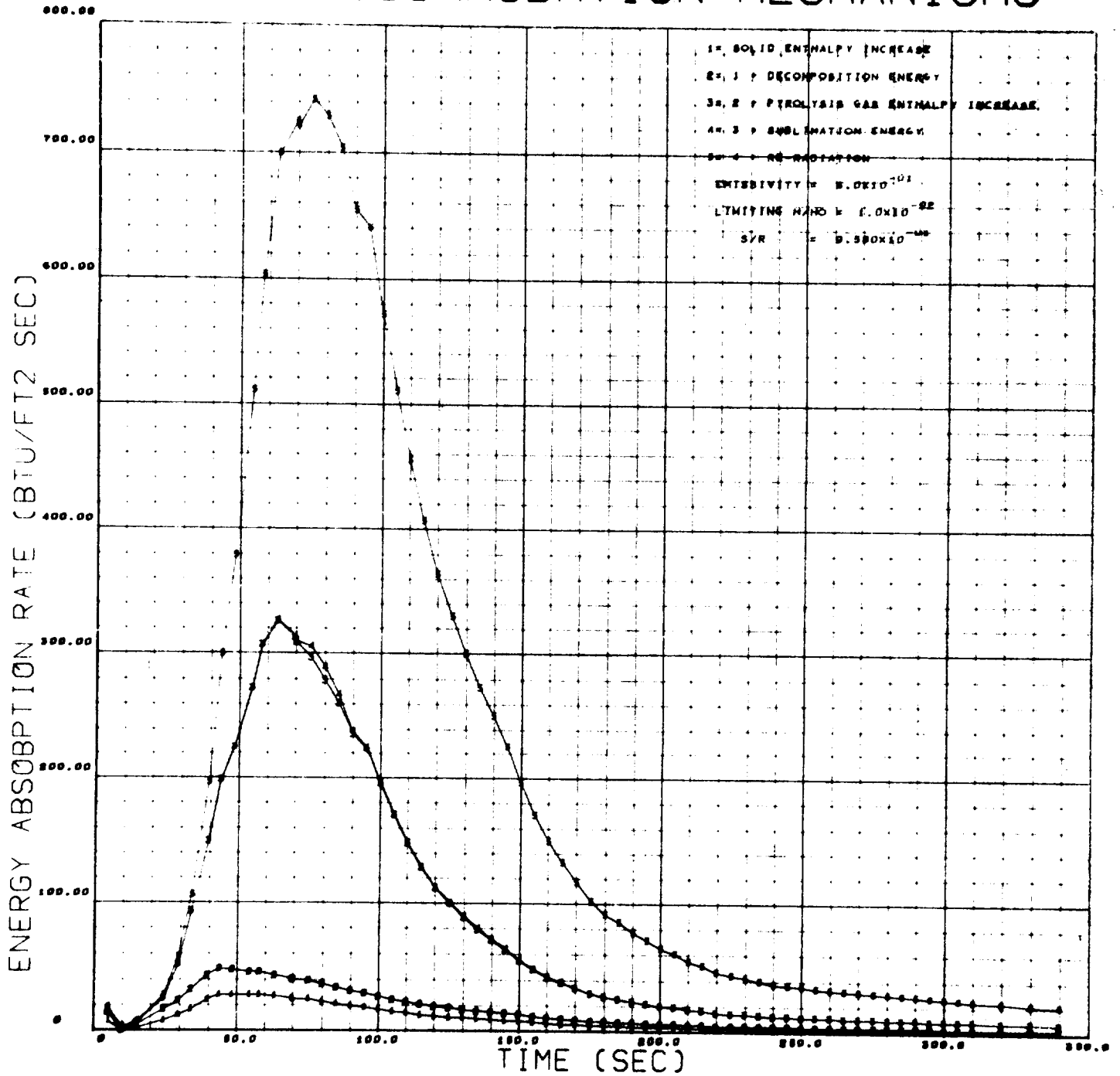


FIGURE A104

HEATING RATE HISTORY

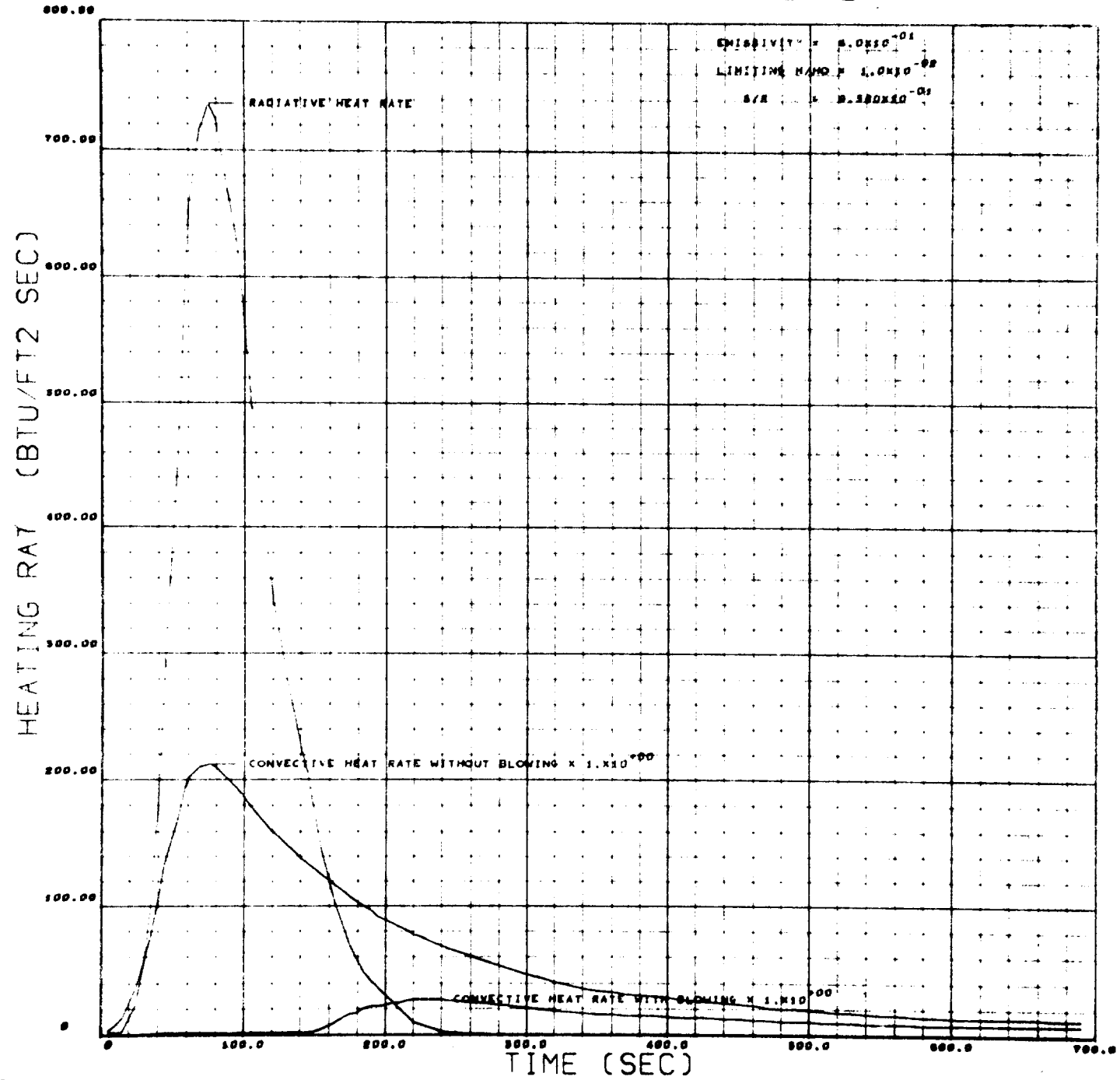


FIGURE A104

MATERIAL RESPONSE DATA

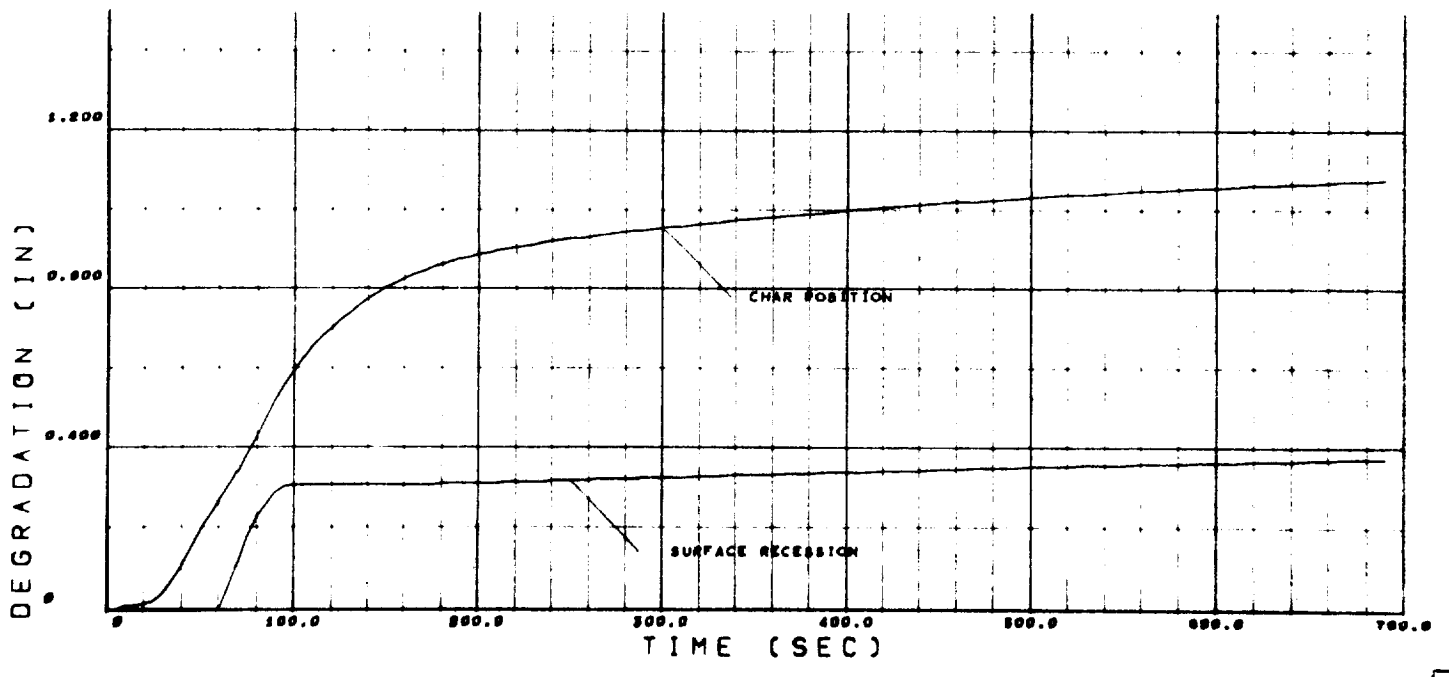
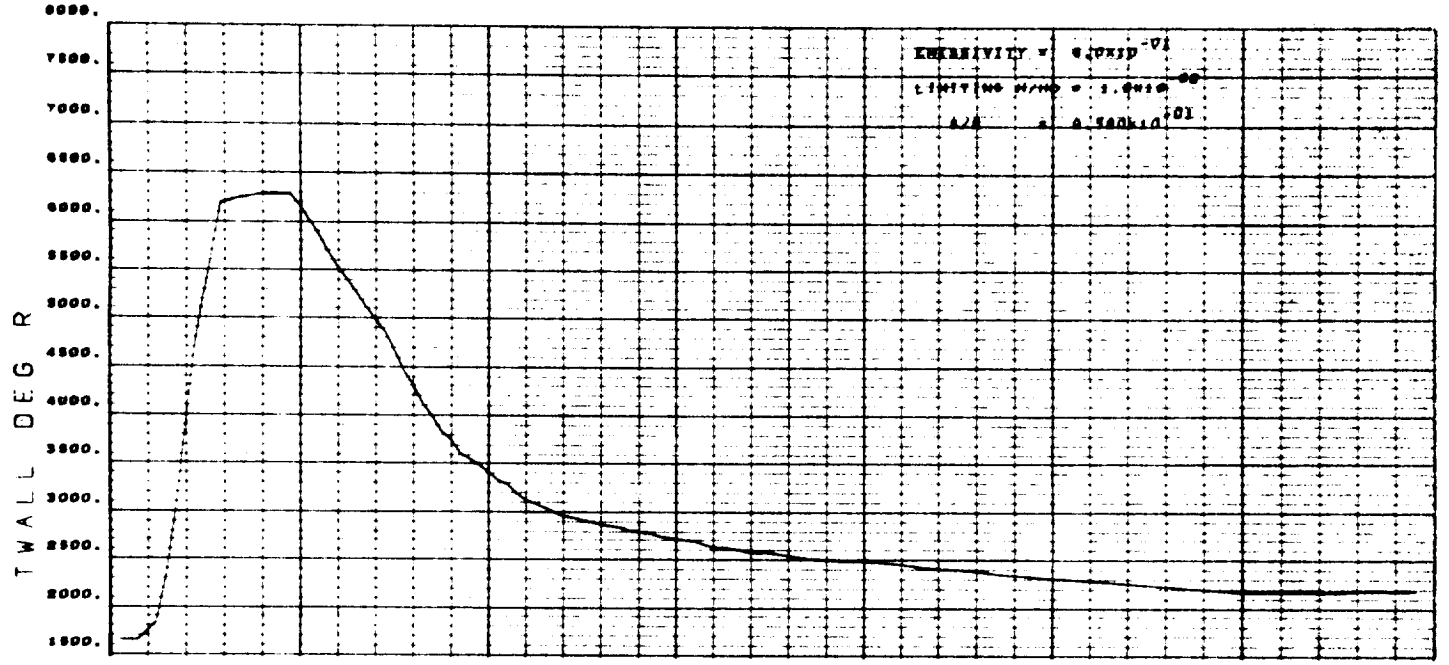


FIGURE A104

ENERGY ACCOMMODATION MECHANISMS

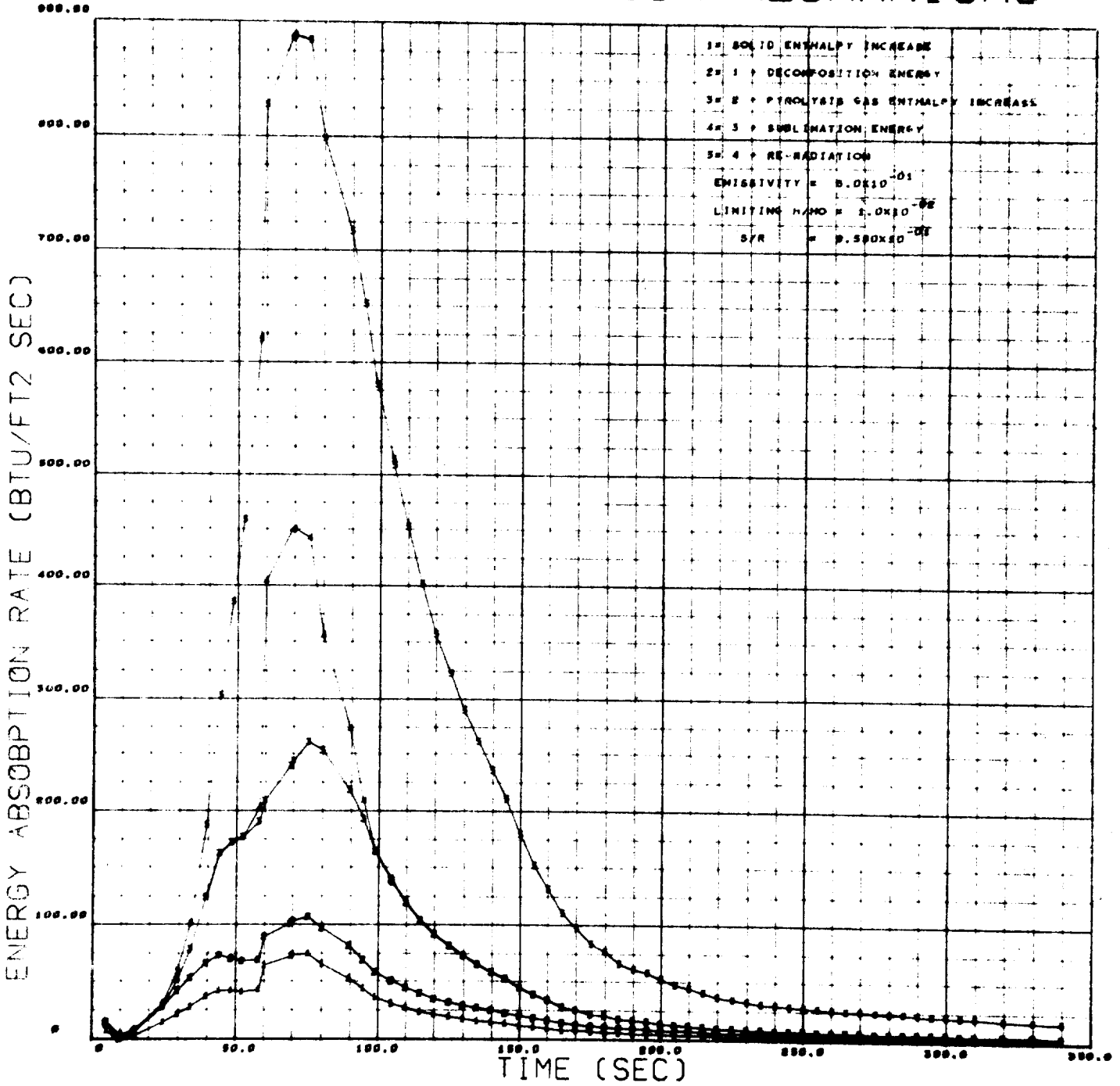


FIGURE A 105

HEATING RATE HISTORY

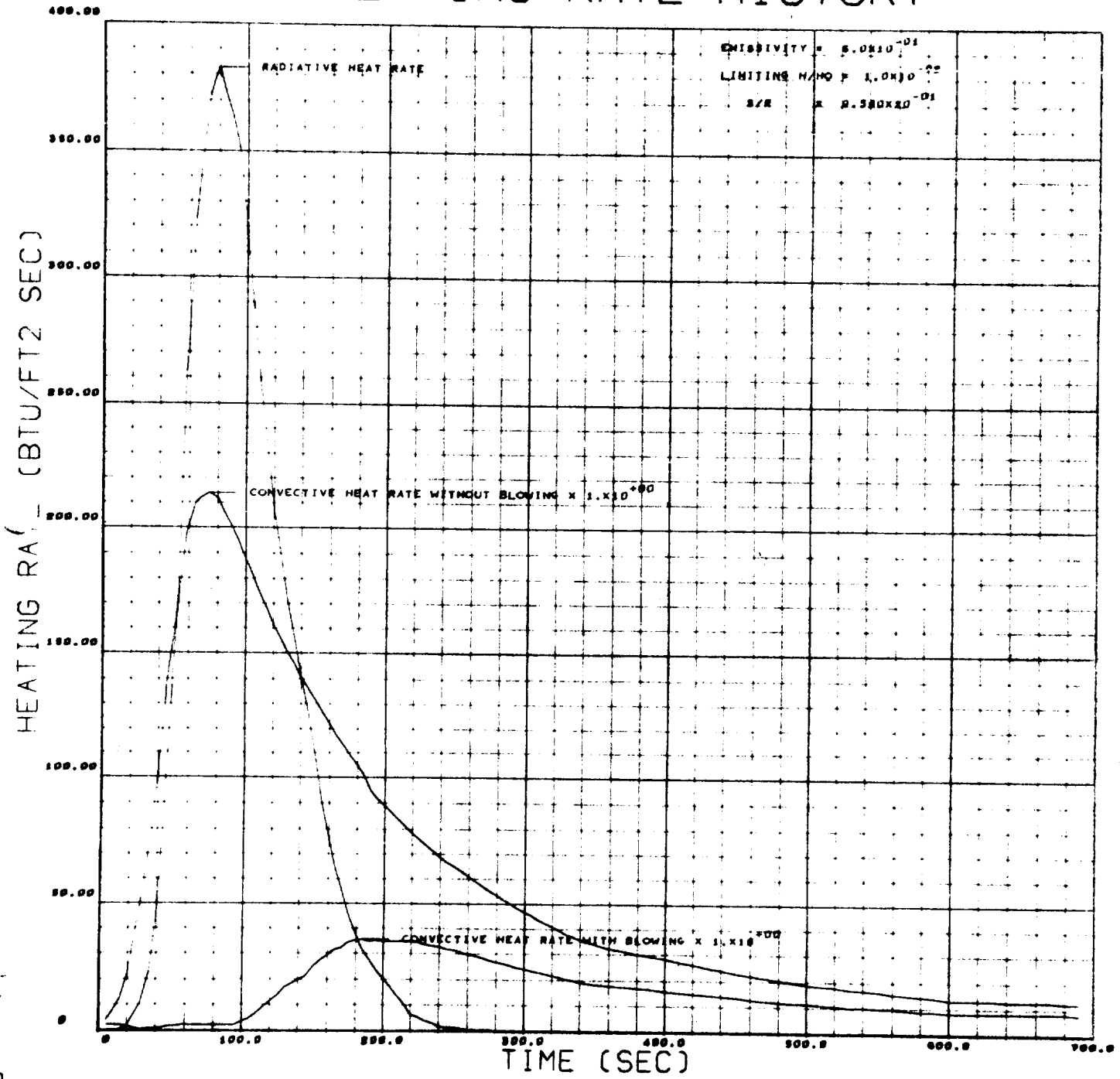


FIGURE A105

MATERIAL RESPONSE DATA

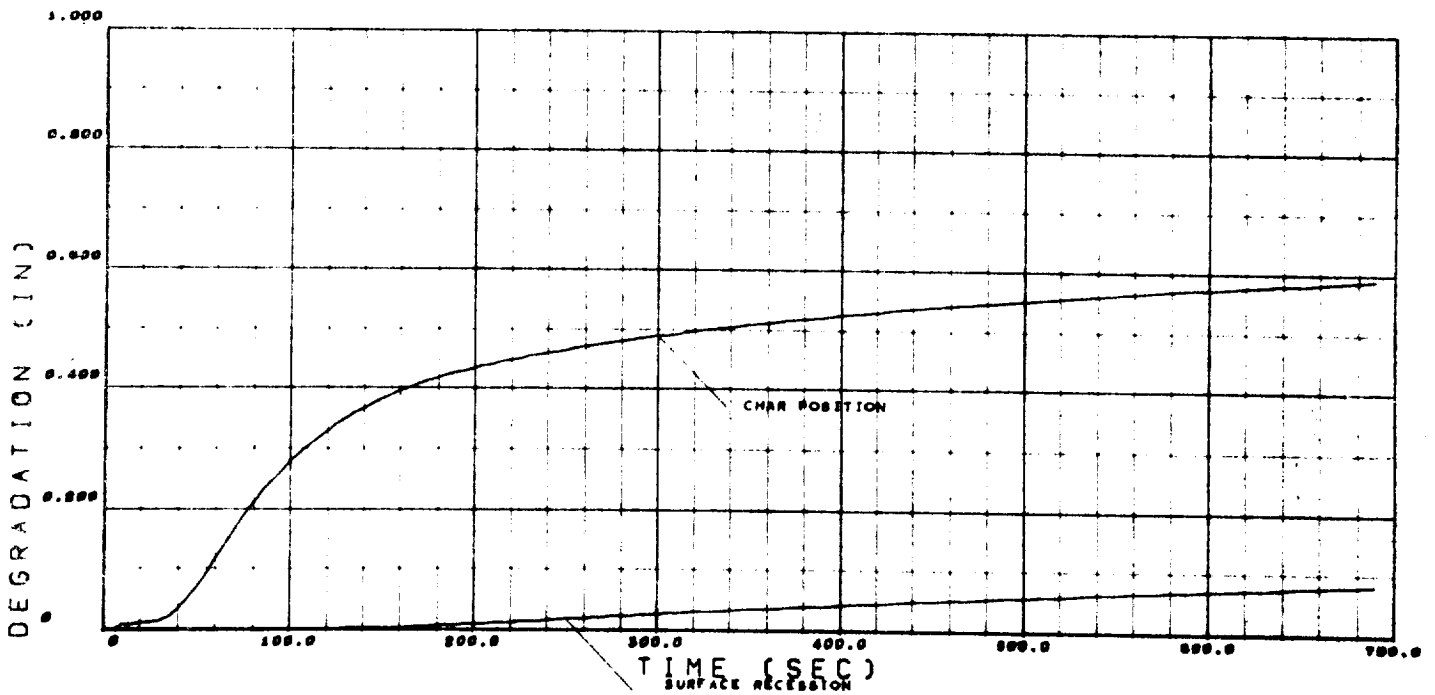
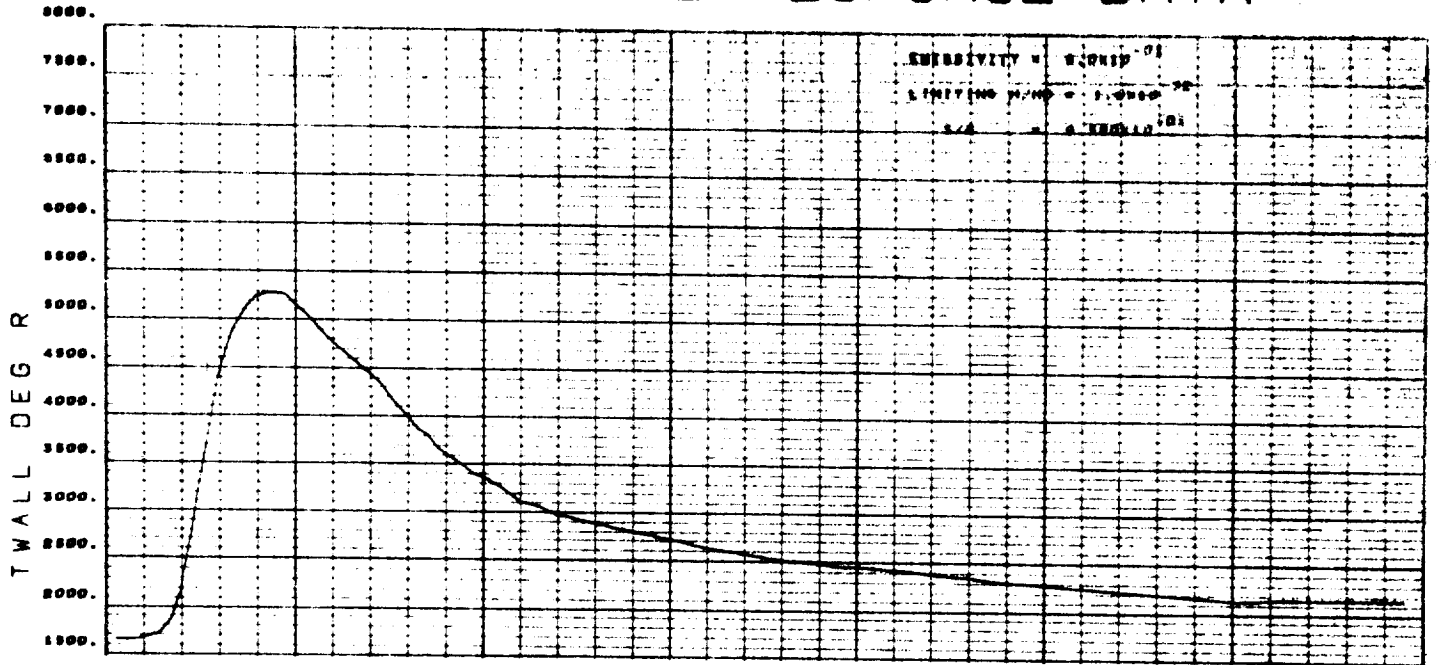


FIGURE A105

ENERGY ACCOMMODATION MECHANISMS

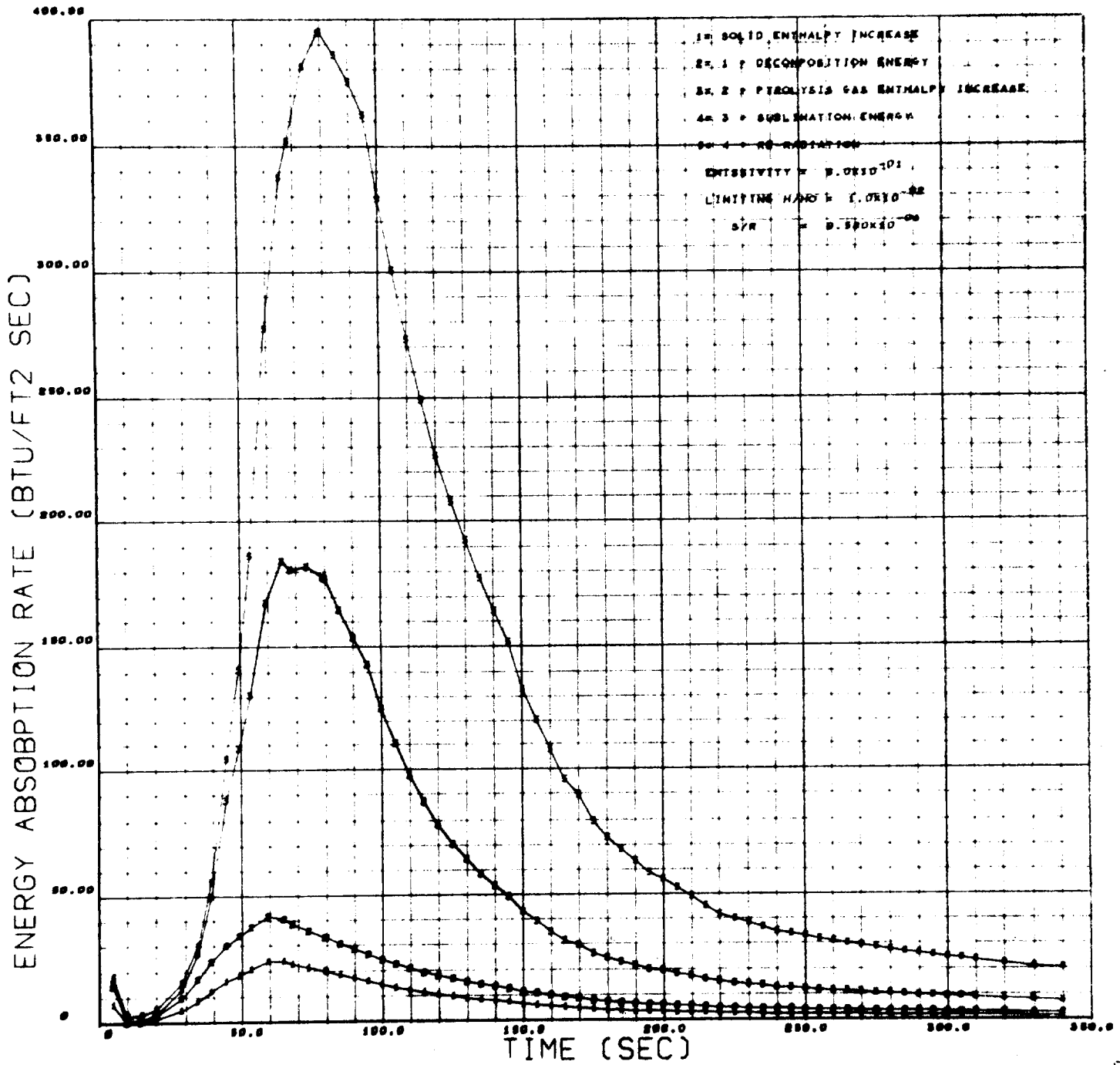


FIGURE A-106

HEATING RATE HISTORY

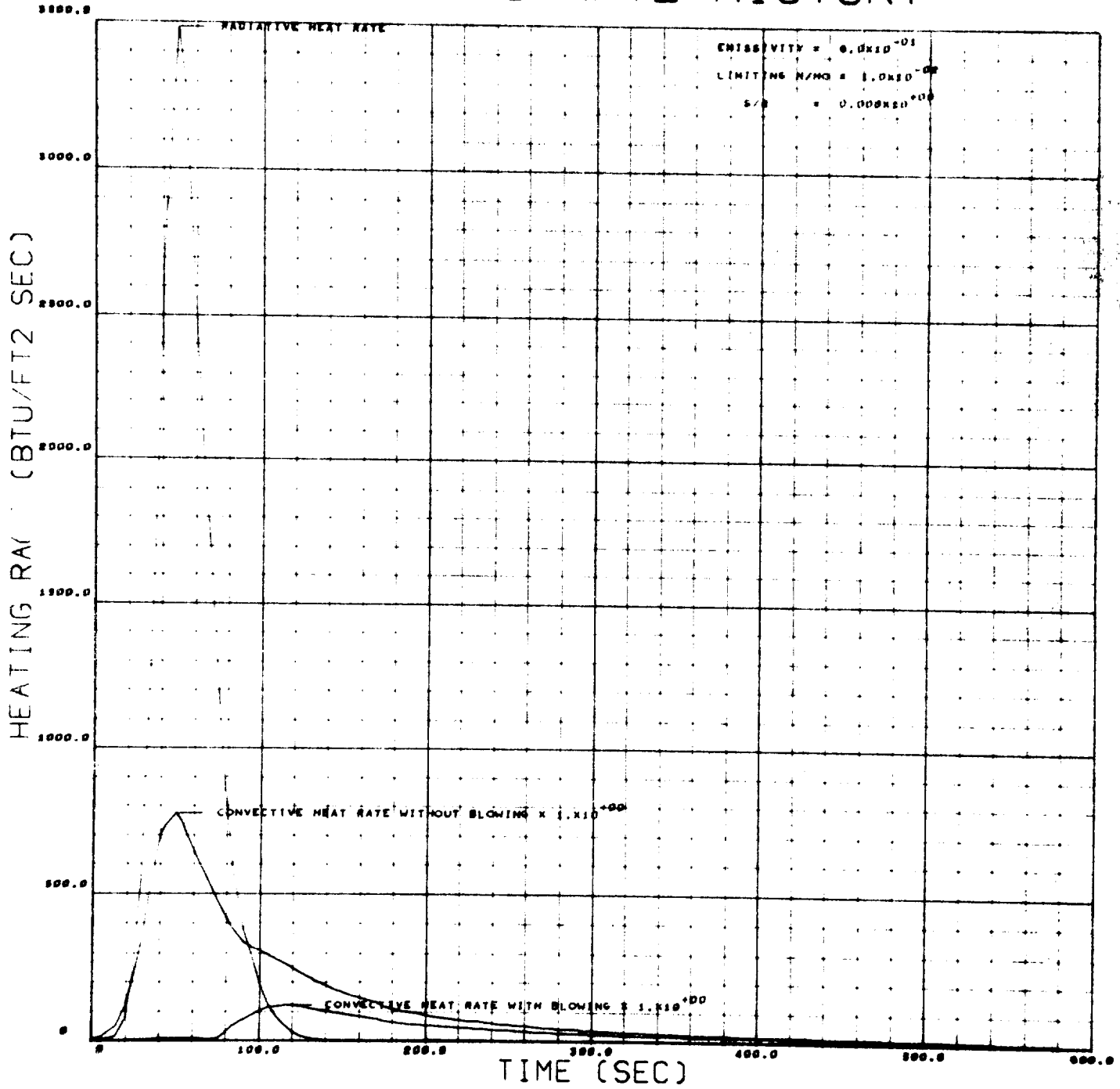


FIGURE A106

MATERIAL RESPONSE DATA

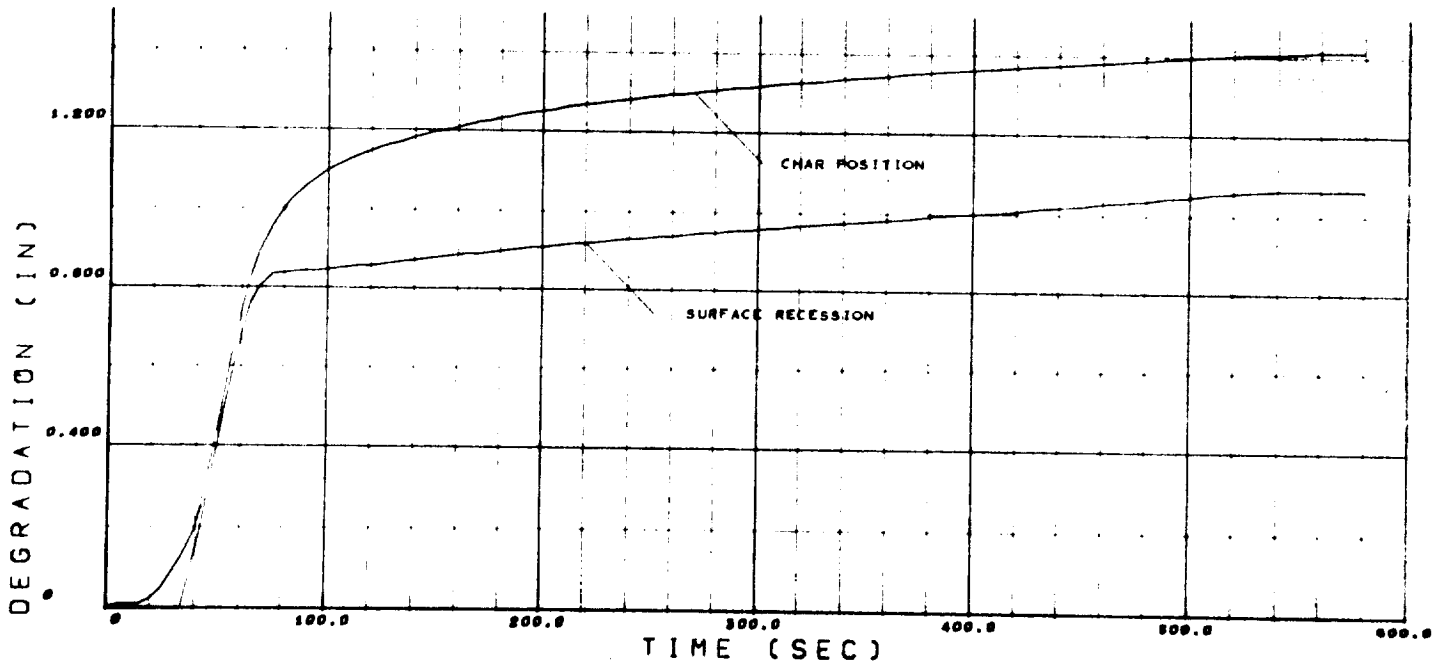
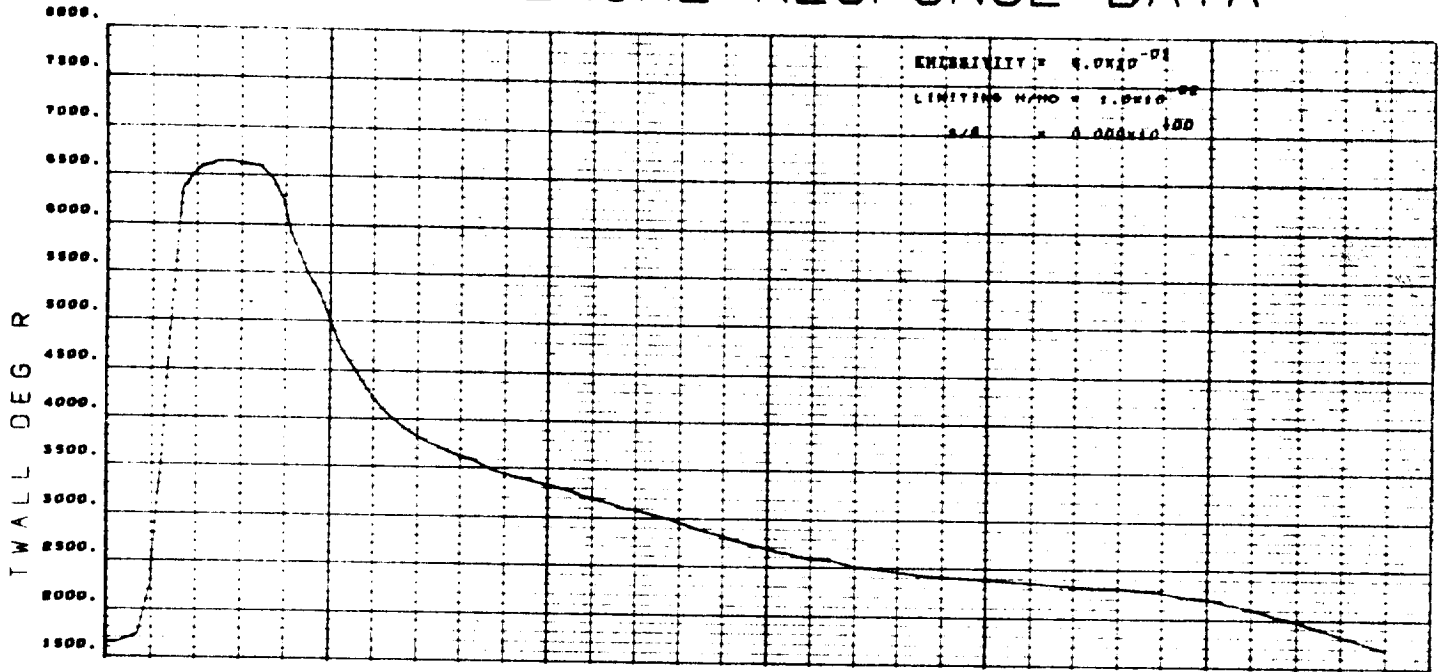


FIGURE A 106

ENERGY ACCOMMODATION MECHANISMS

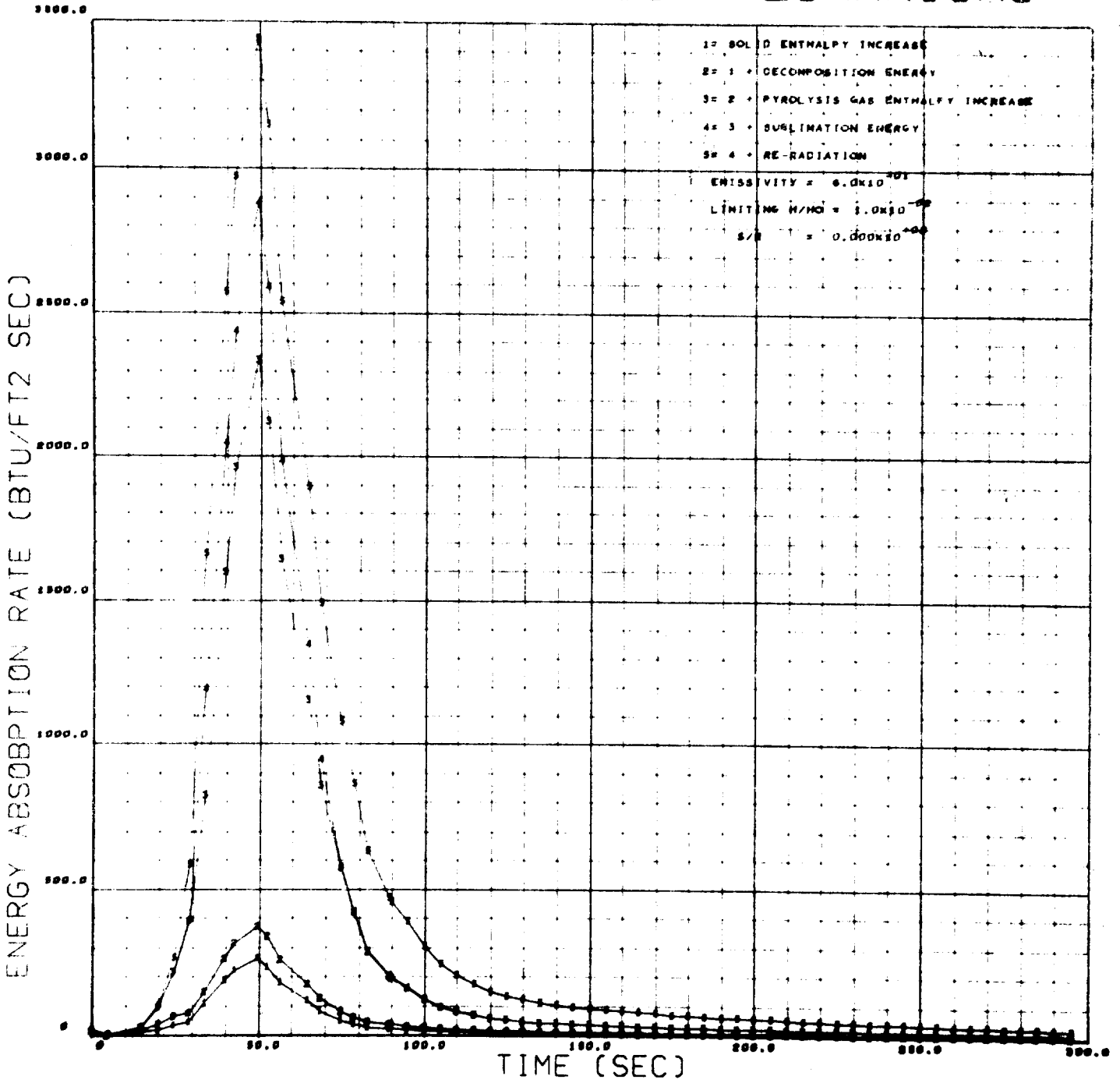


FIGURE A 107

HEATING RATE HISTORY

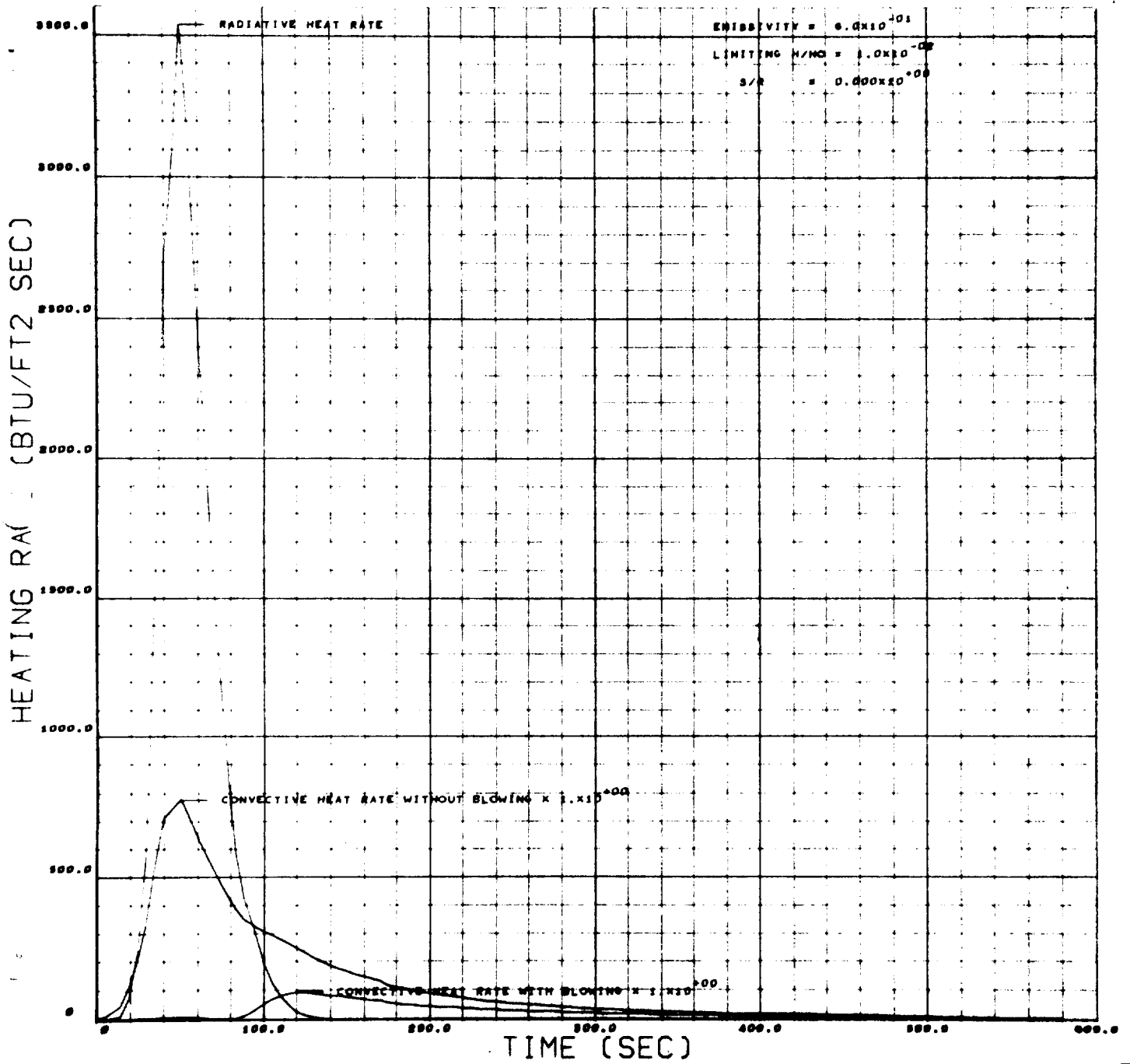


FIGURE A107

MATERIAL RESPONSE DATA

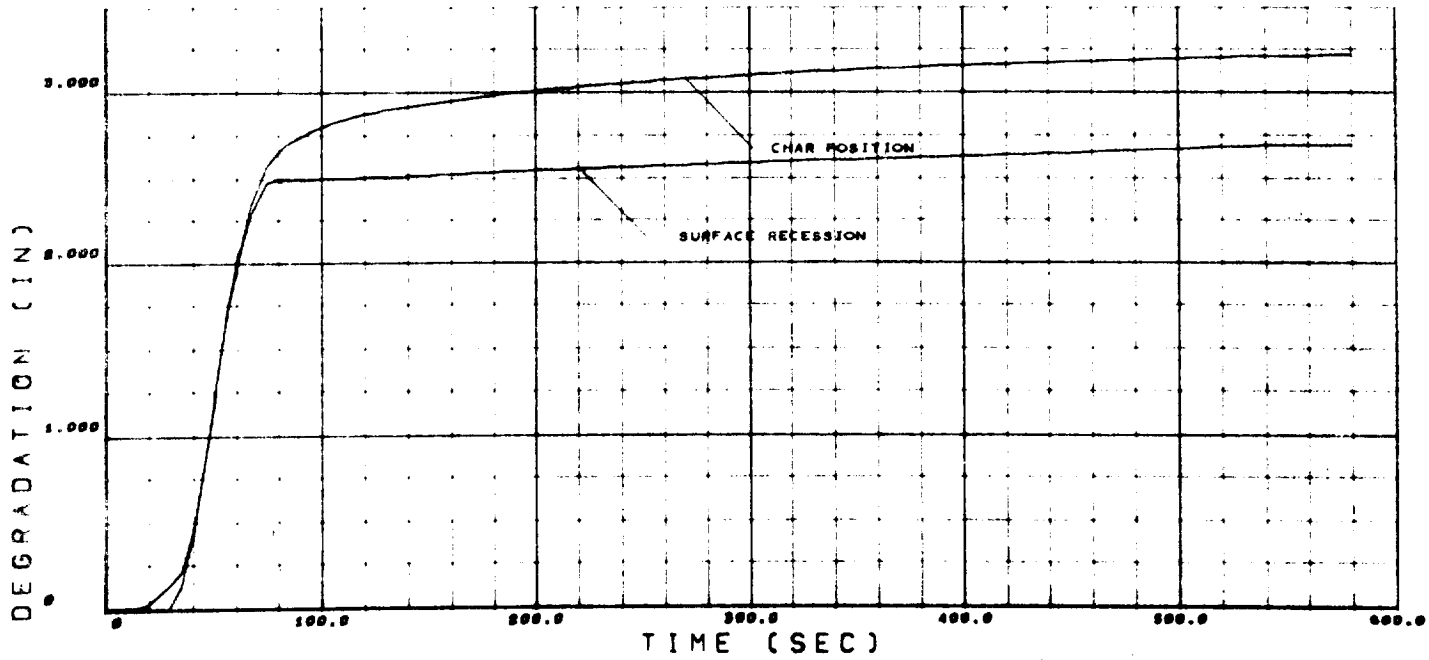
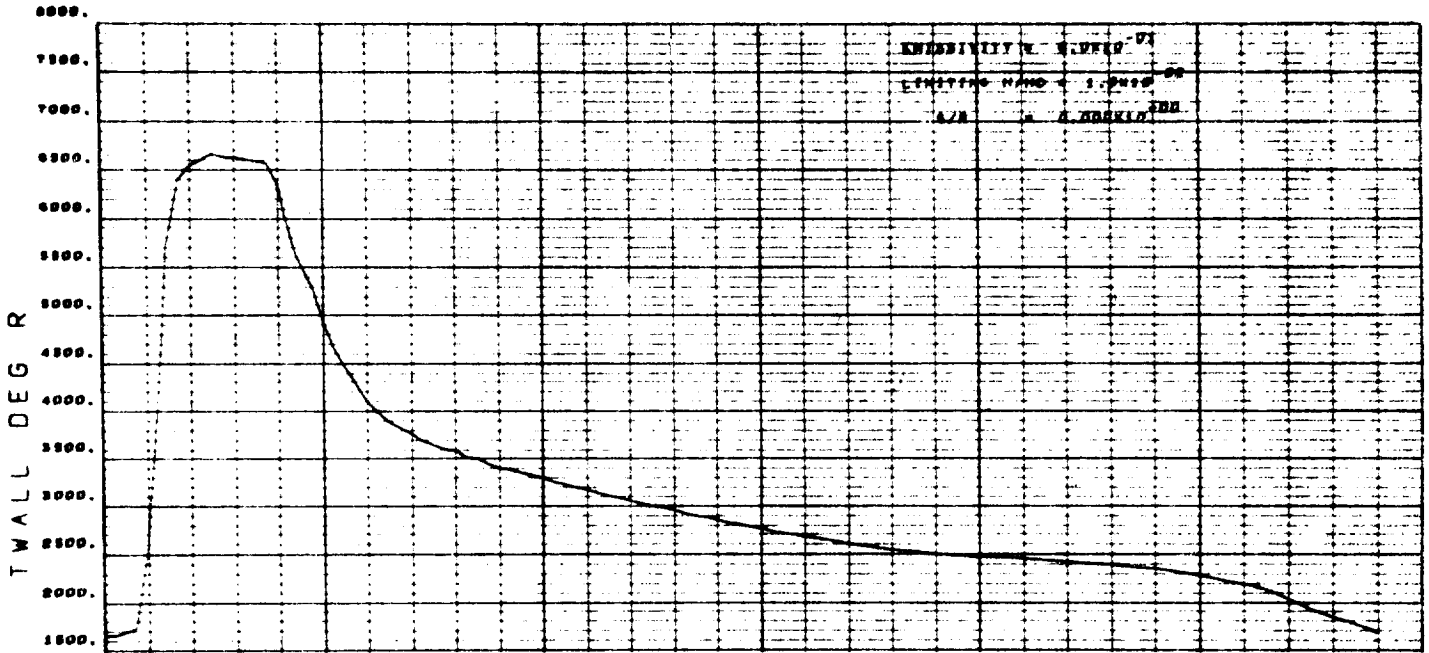


FIGURE A107

ENERGY ACCOMMODATION MECHANISMS

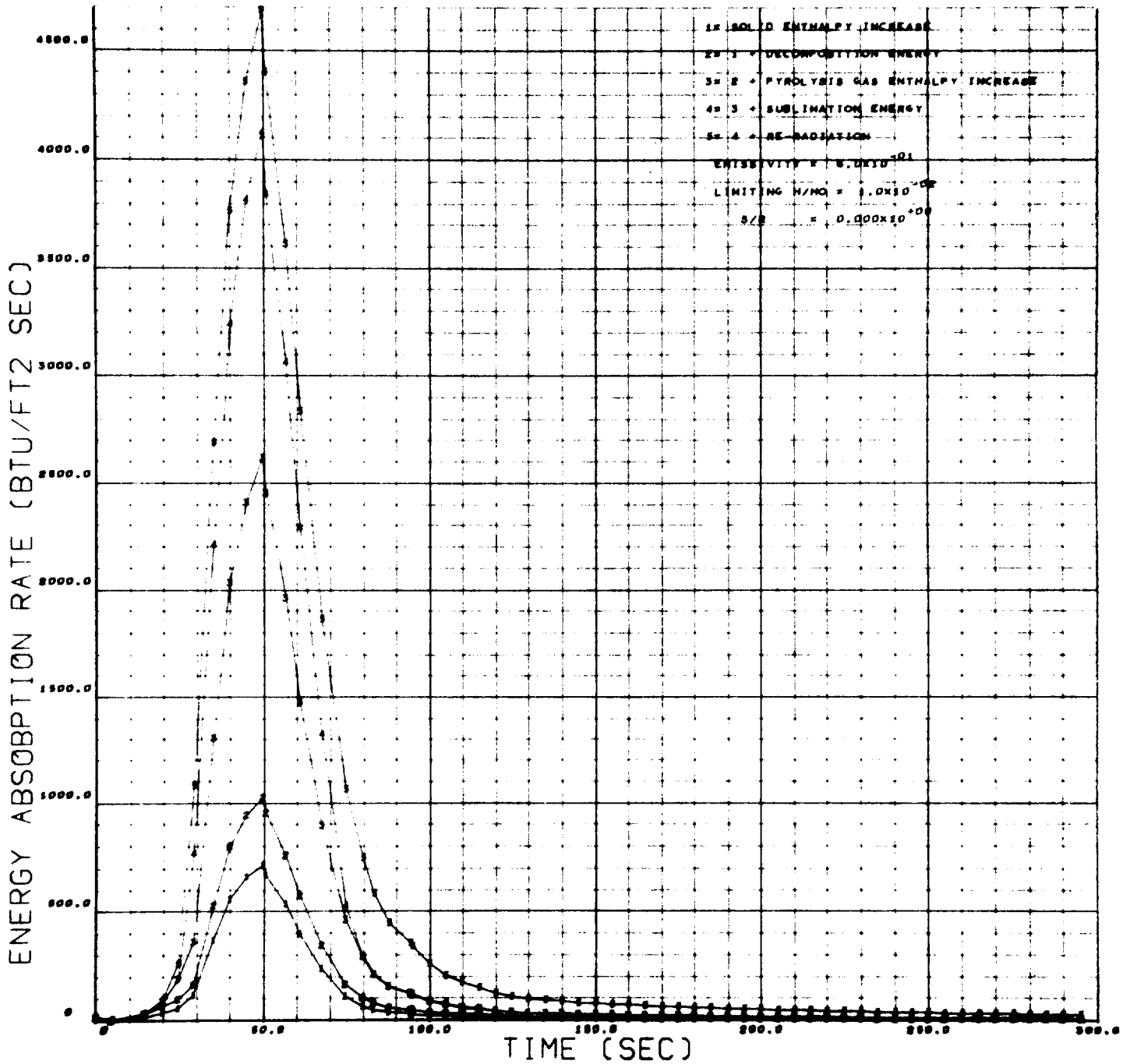


FIGURE A108

HEATING RATE HISTORY

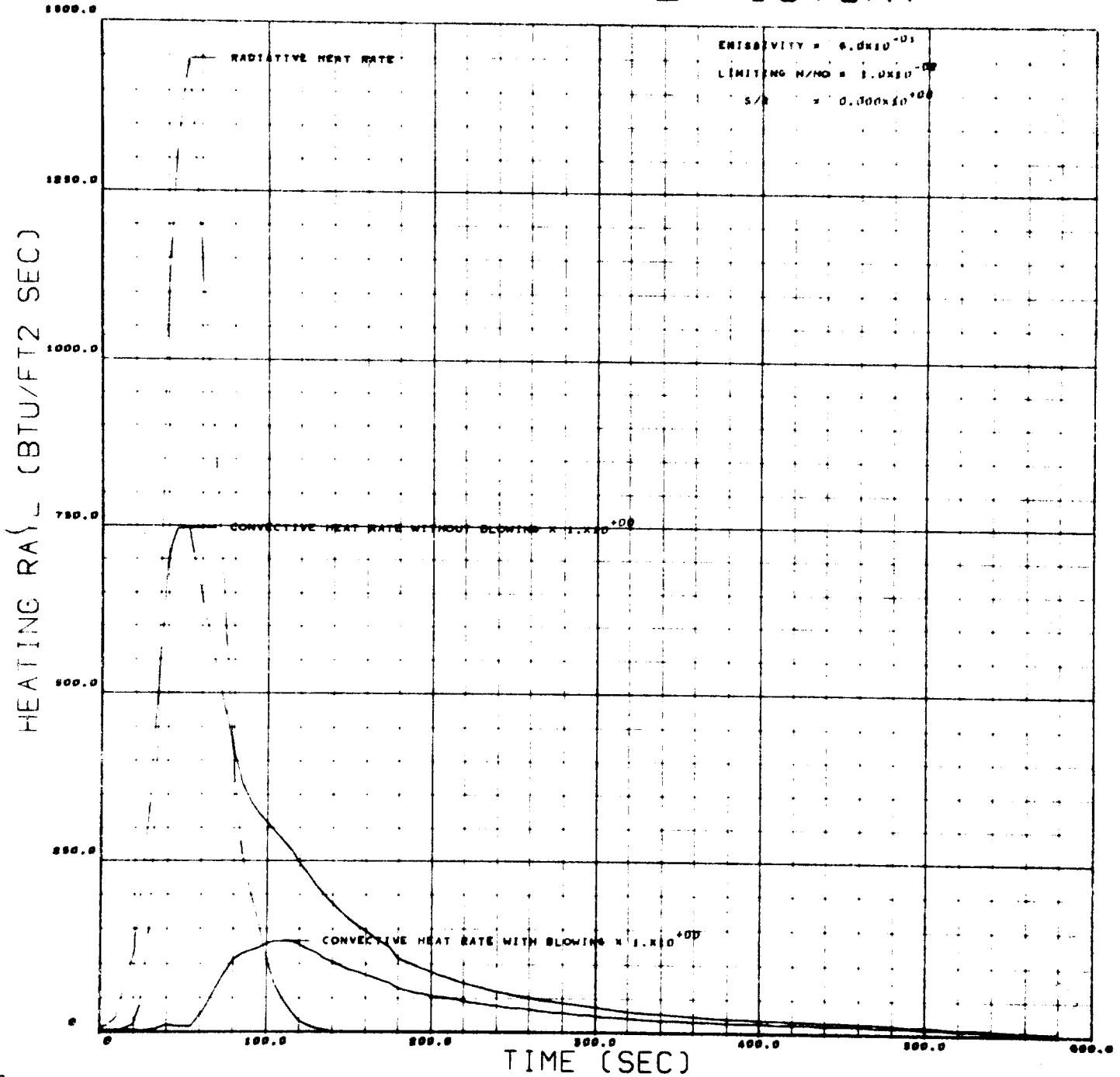


FIGURE A108

MATERIAL RESPONSE DATA

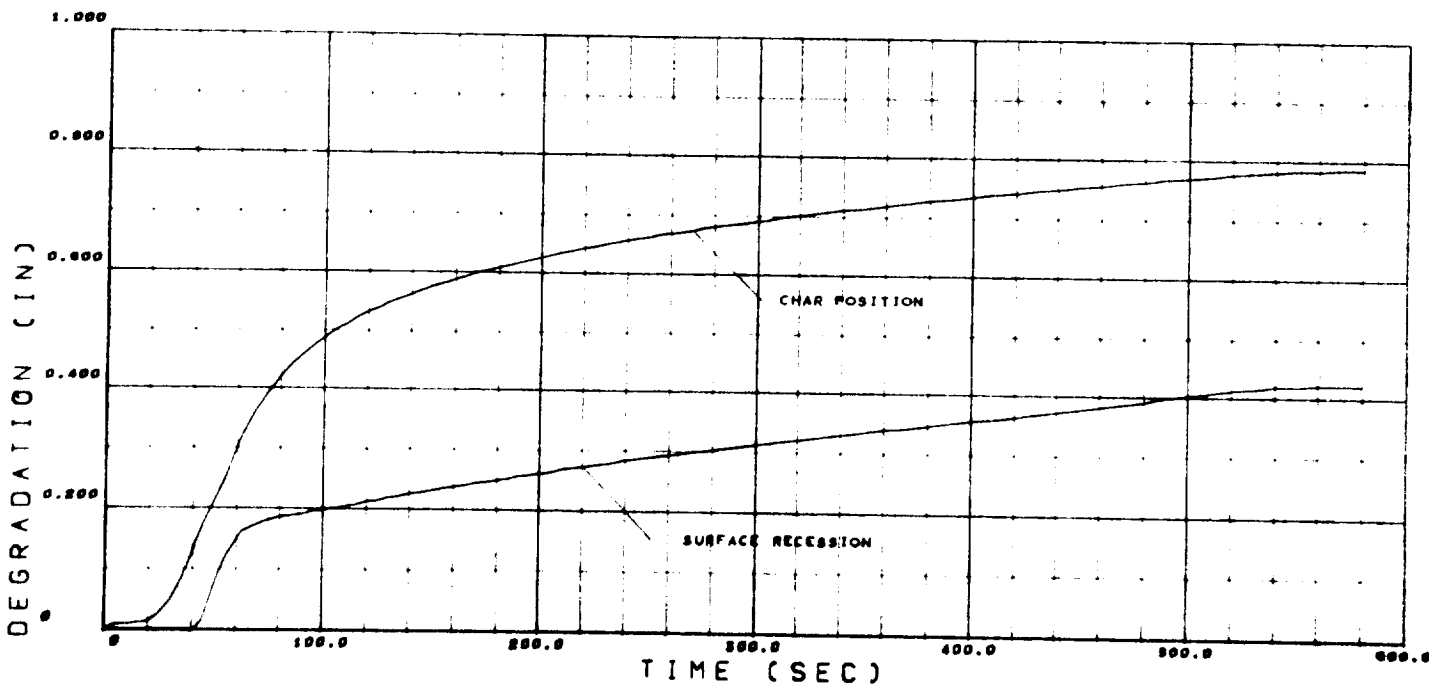
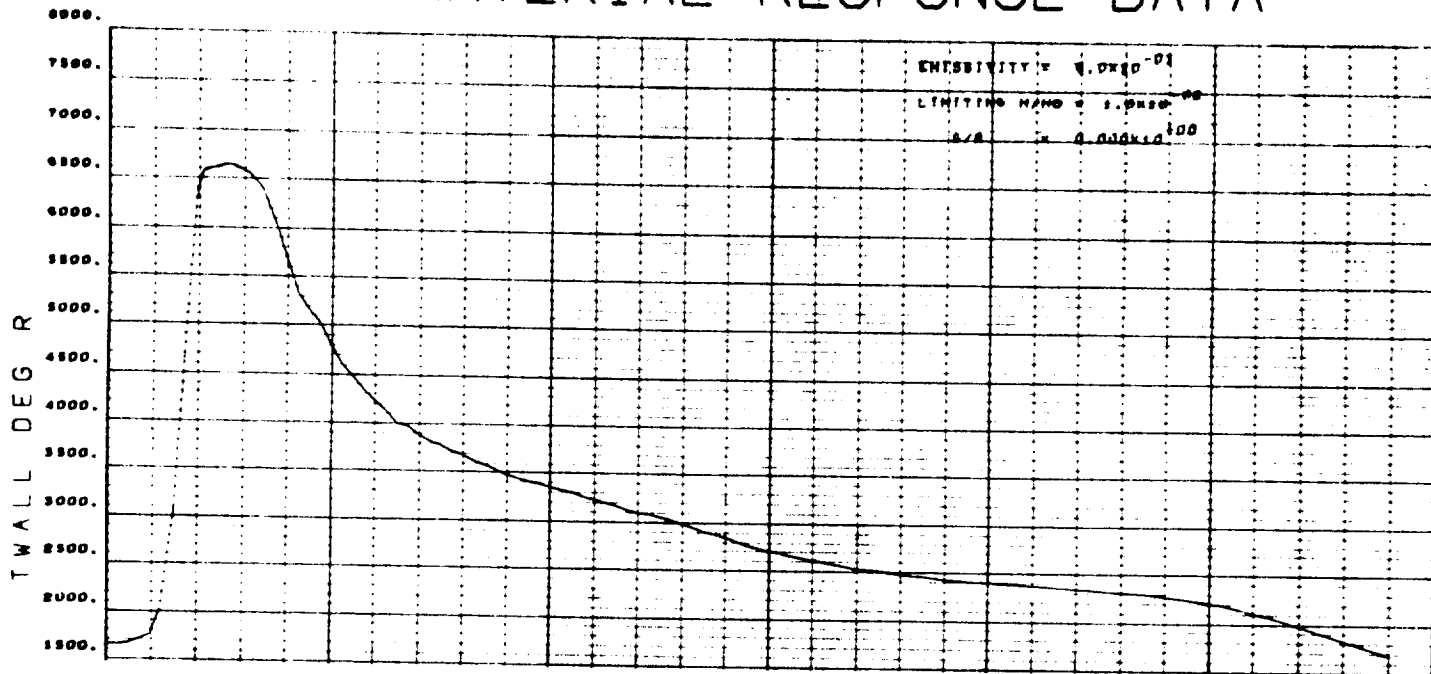


FIGURE A108

ENERGY ACCOMMODATION MECHANISMS

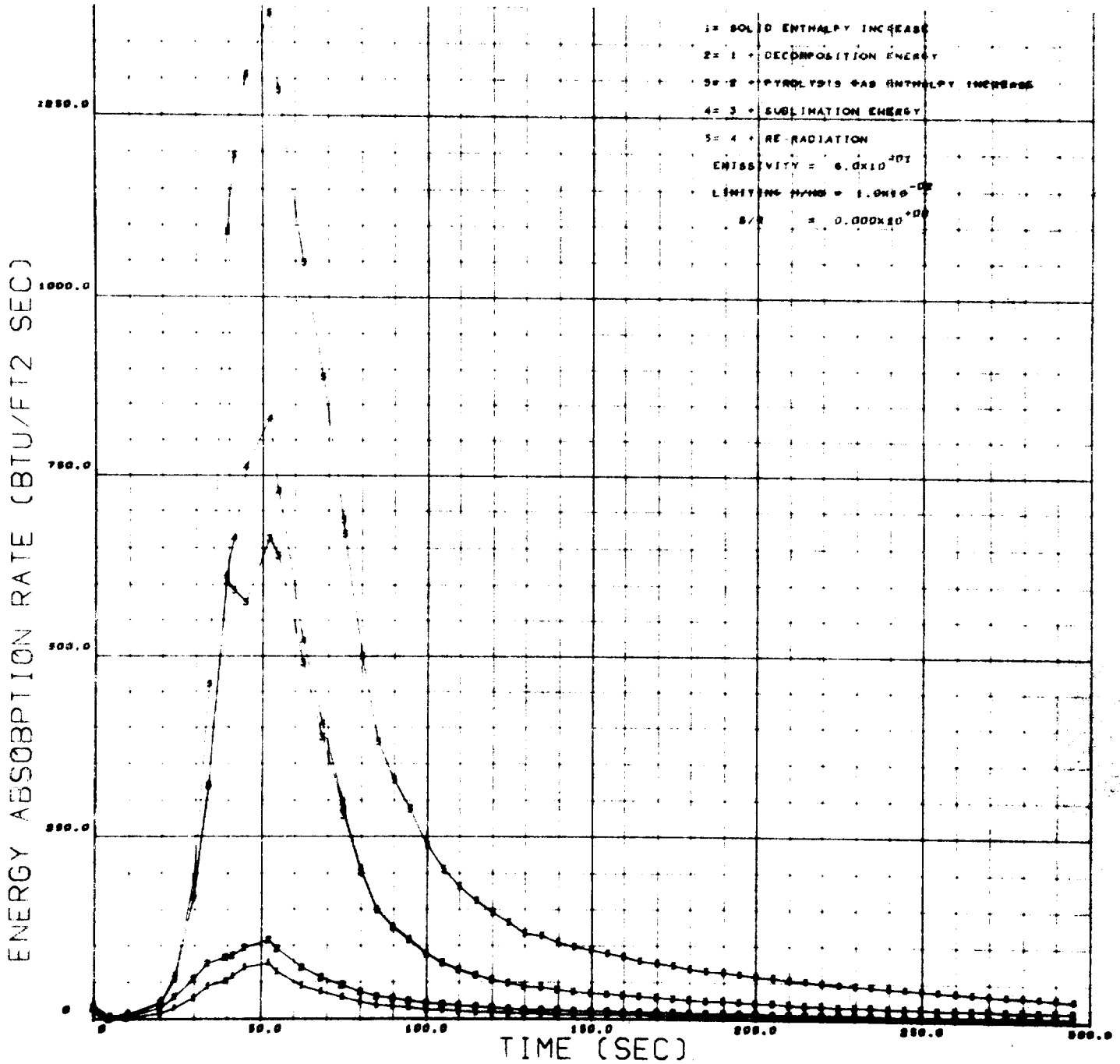


FIGURE A 109

HEATING RATE HISTORY

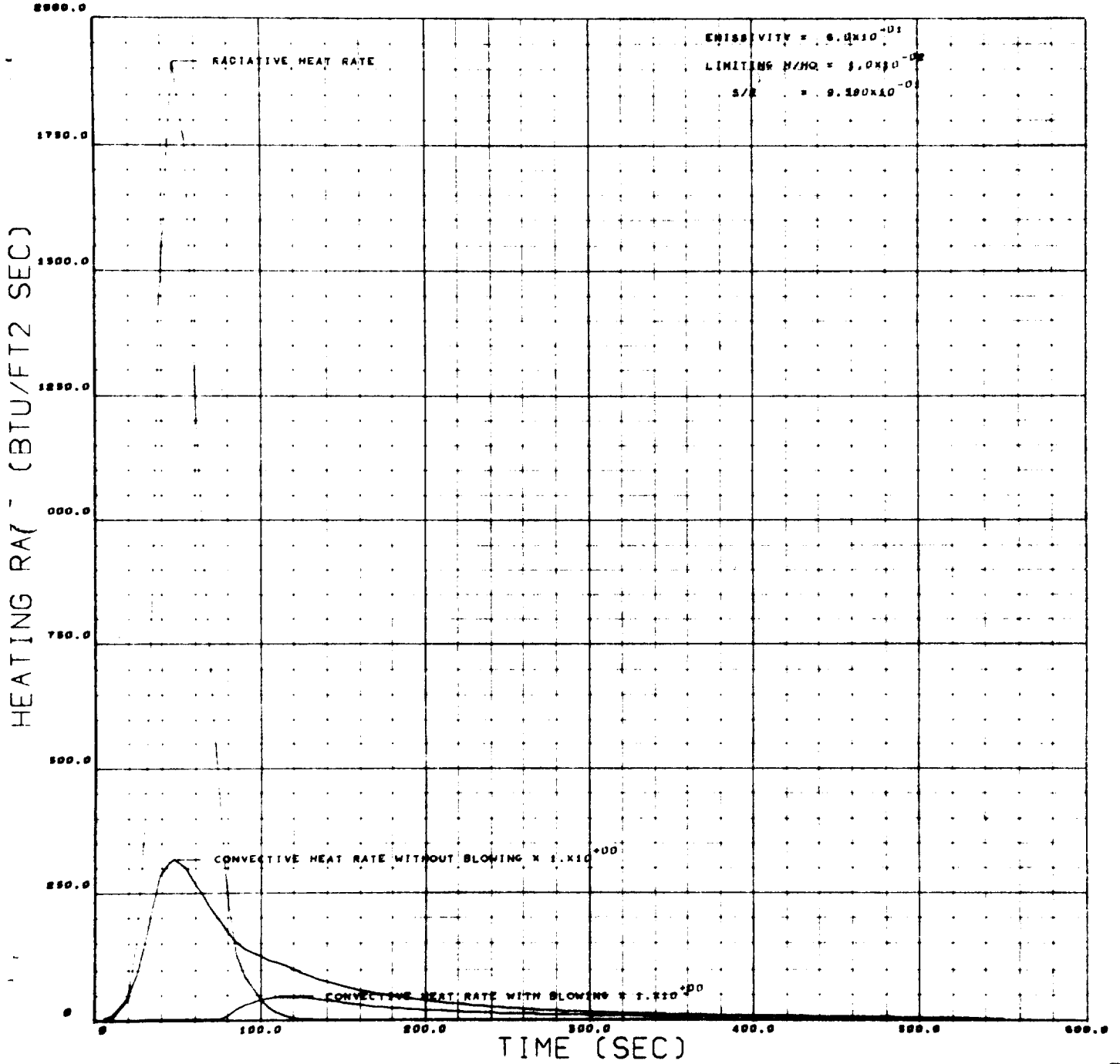


FIGURE A109

MATERIAL RESPONSE DATA

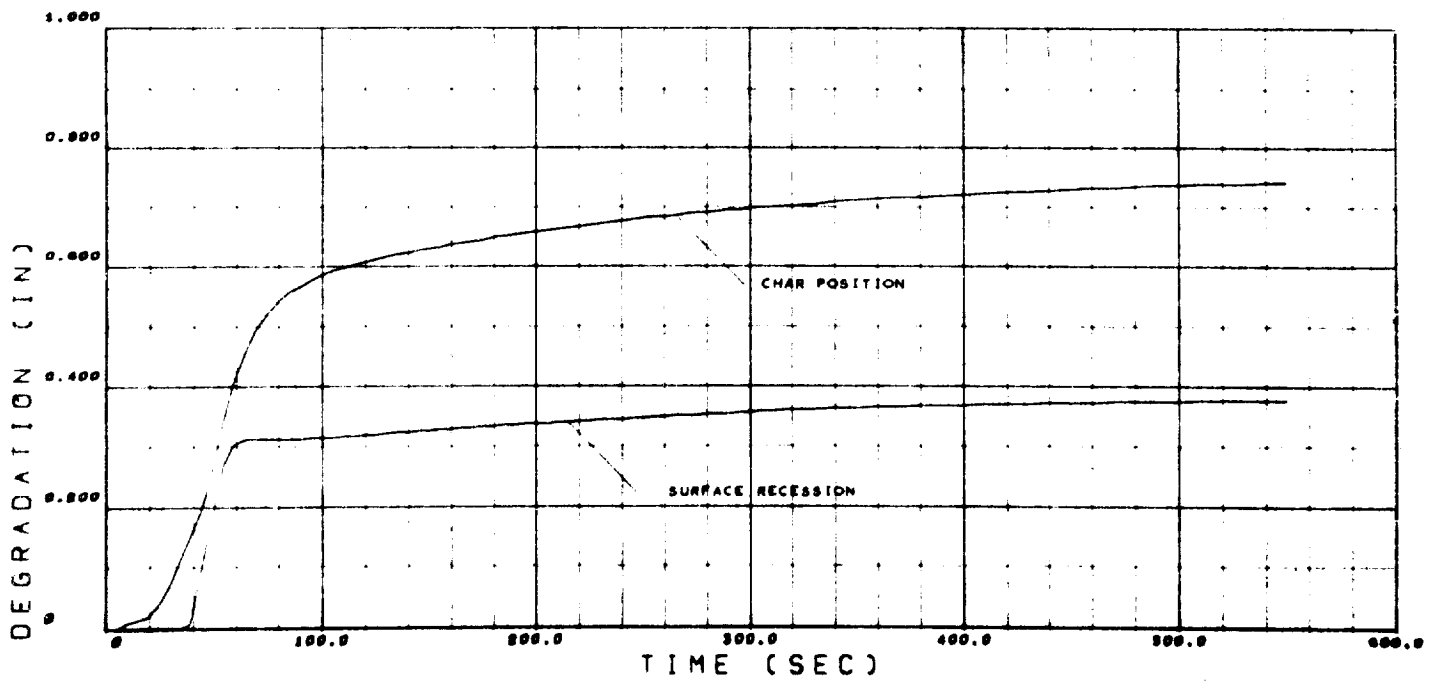
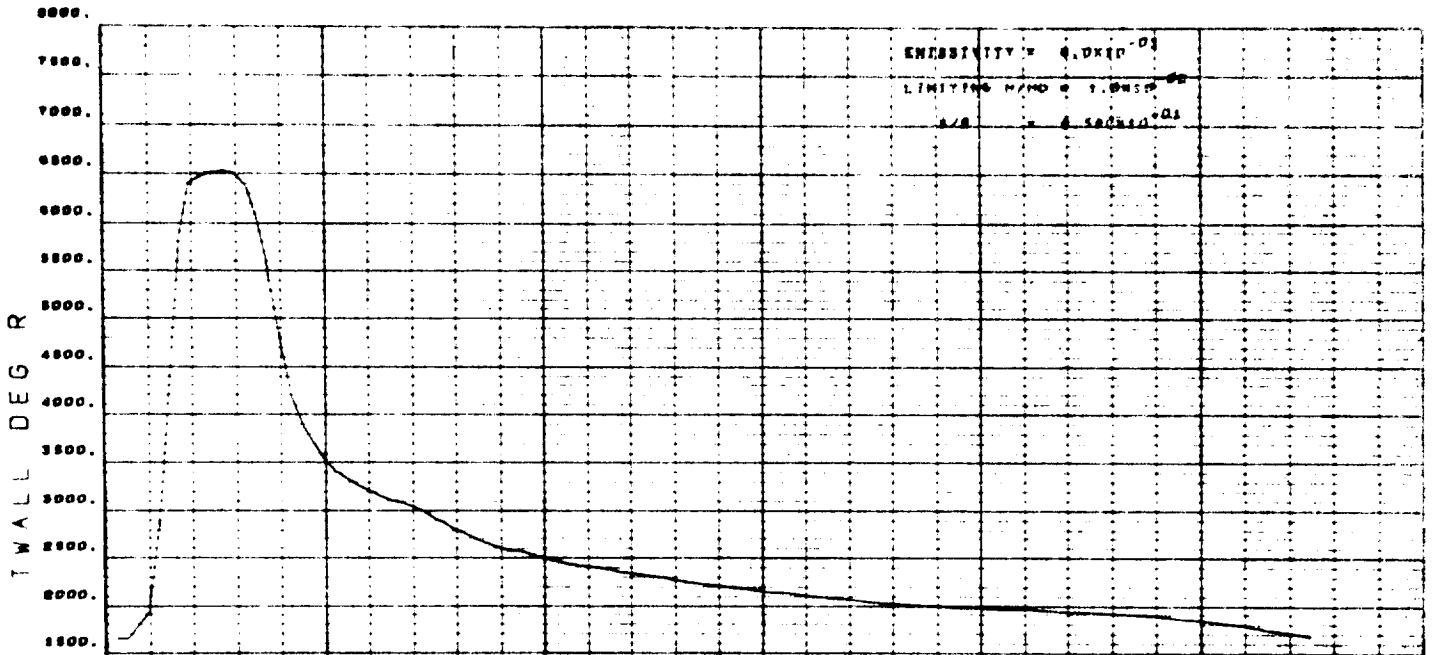


FIGURE A109

ENERGY ACCOMMODATION MECHANISMS

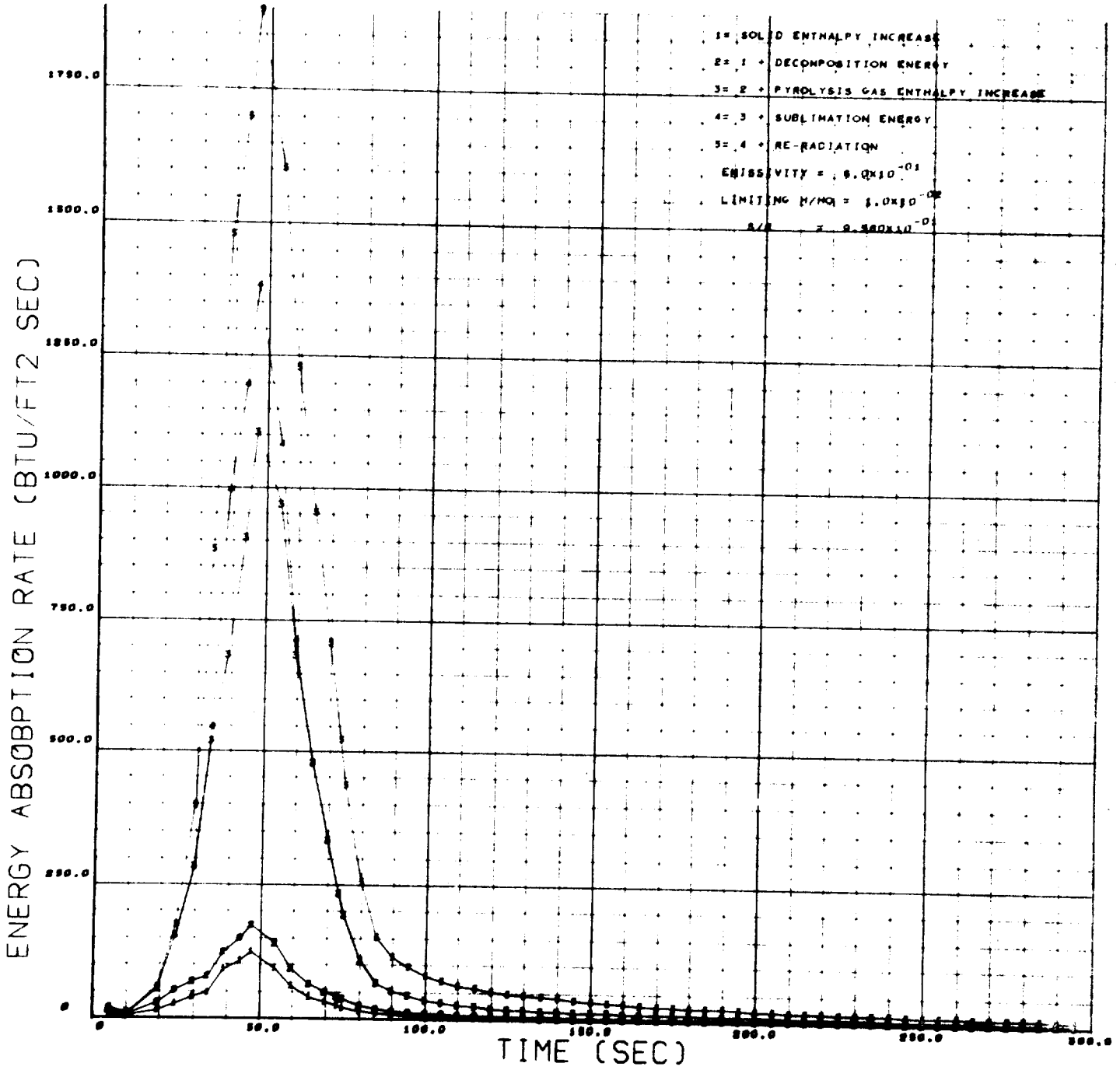


FIGURE A110

HEATING RATE HISTORY

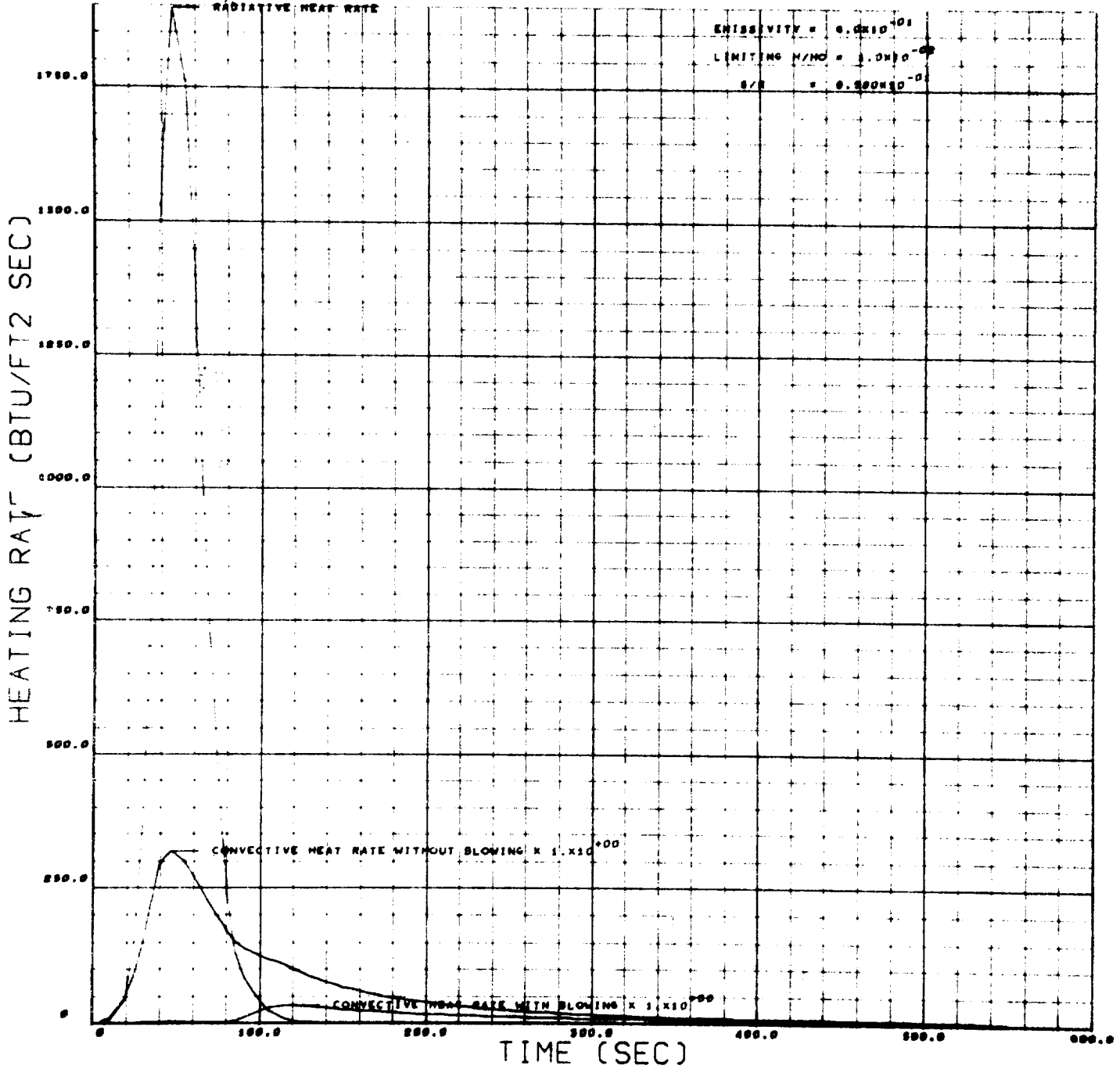


FIGURE A 110

MATERIAL RESPONSE DATA

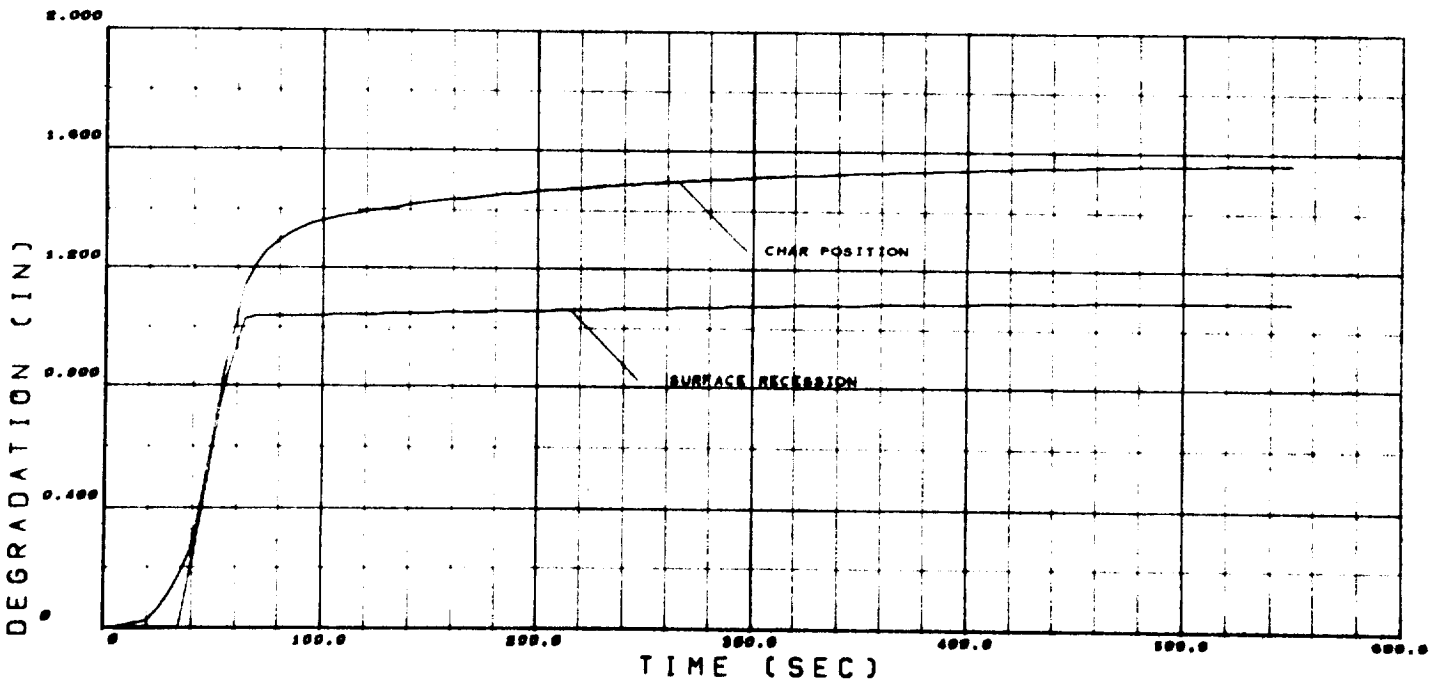
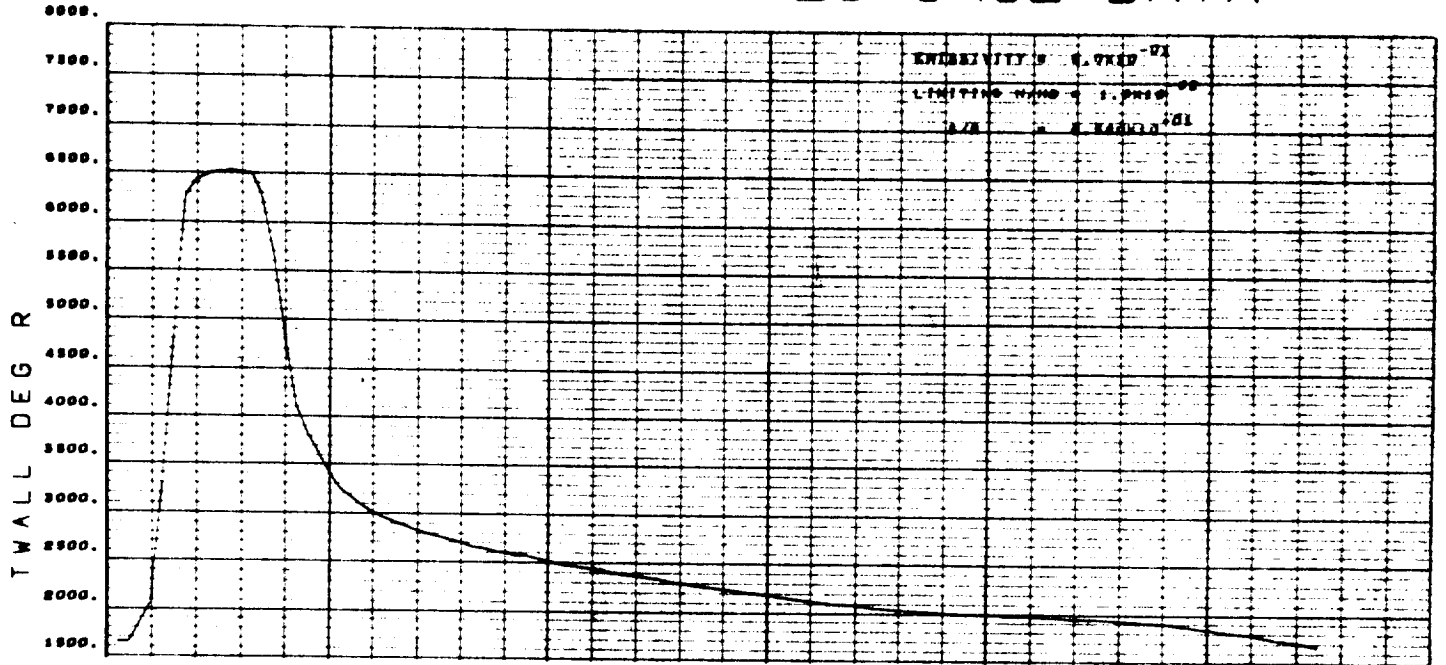


FIGURE A110

ENERGY ACCOMMODATION MECHANISMS

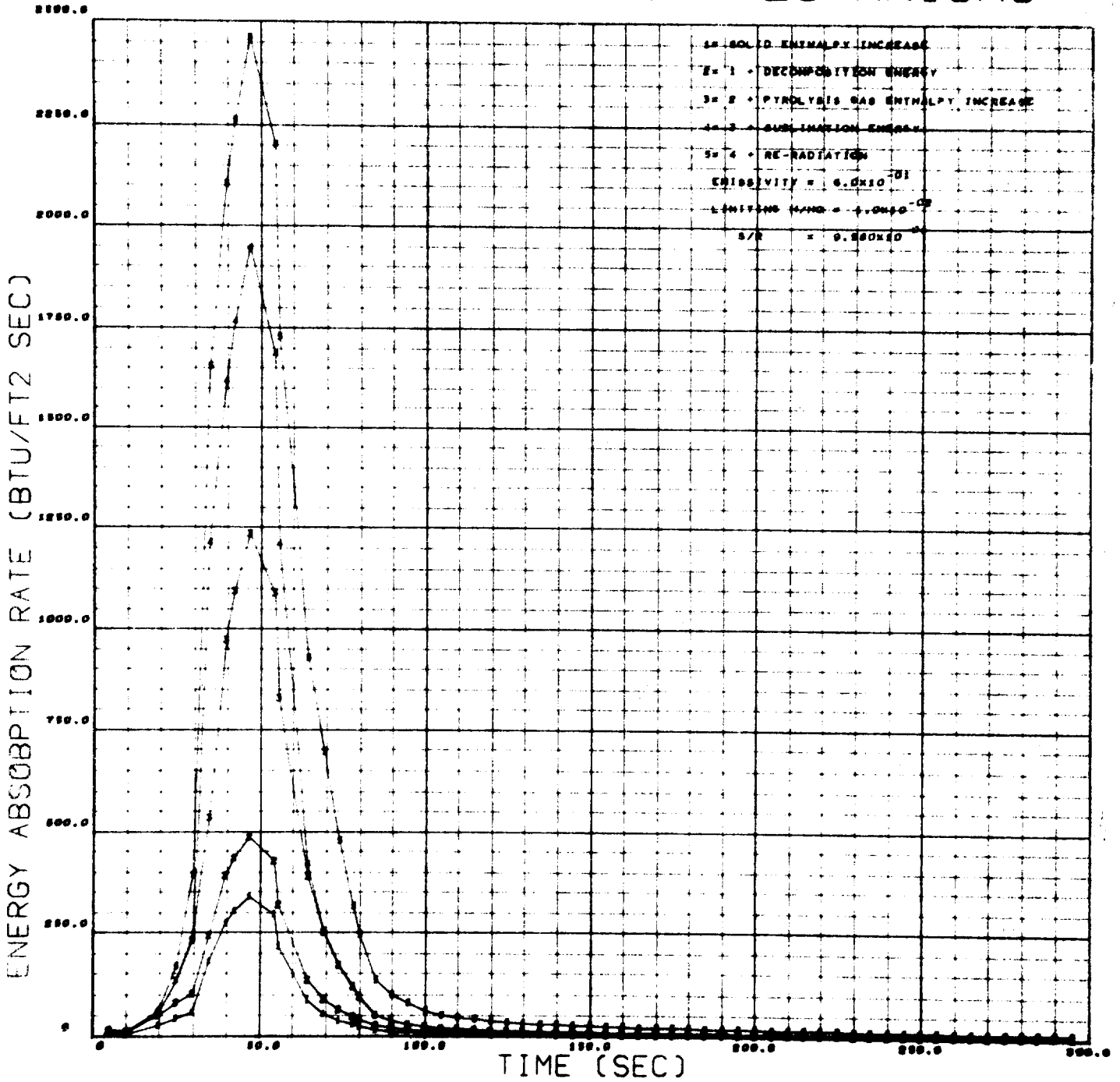


FIGURE A III

HEATING RATE HISTORY

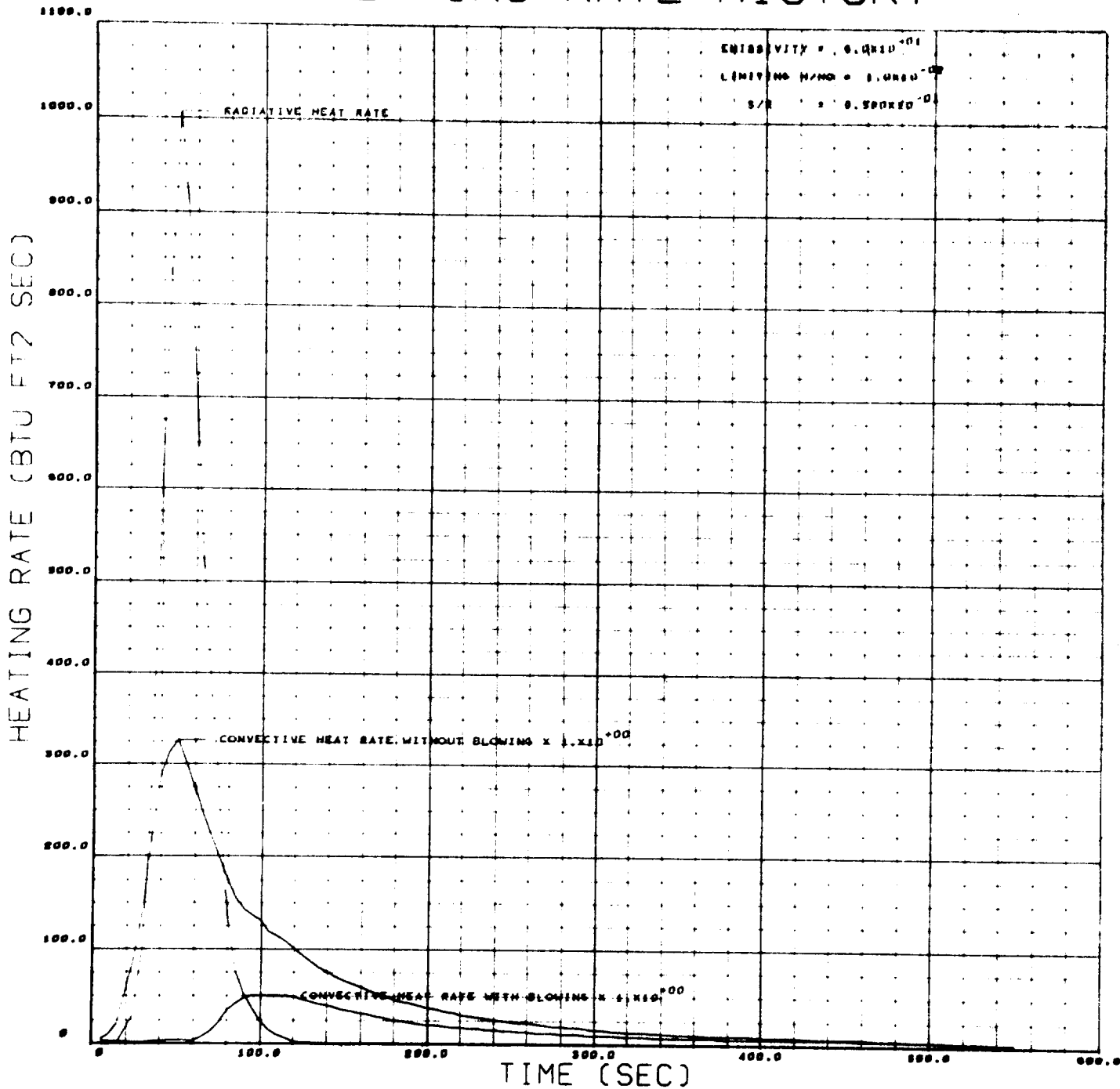


FIGURE A 111

MATERIAL RESPONSE DATA

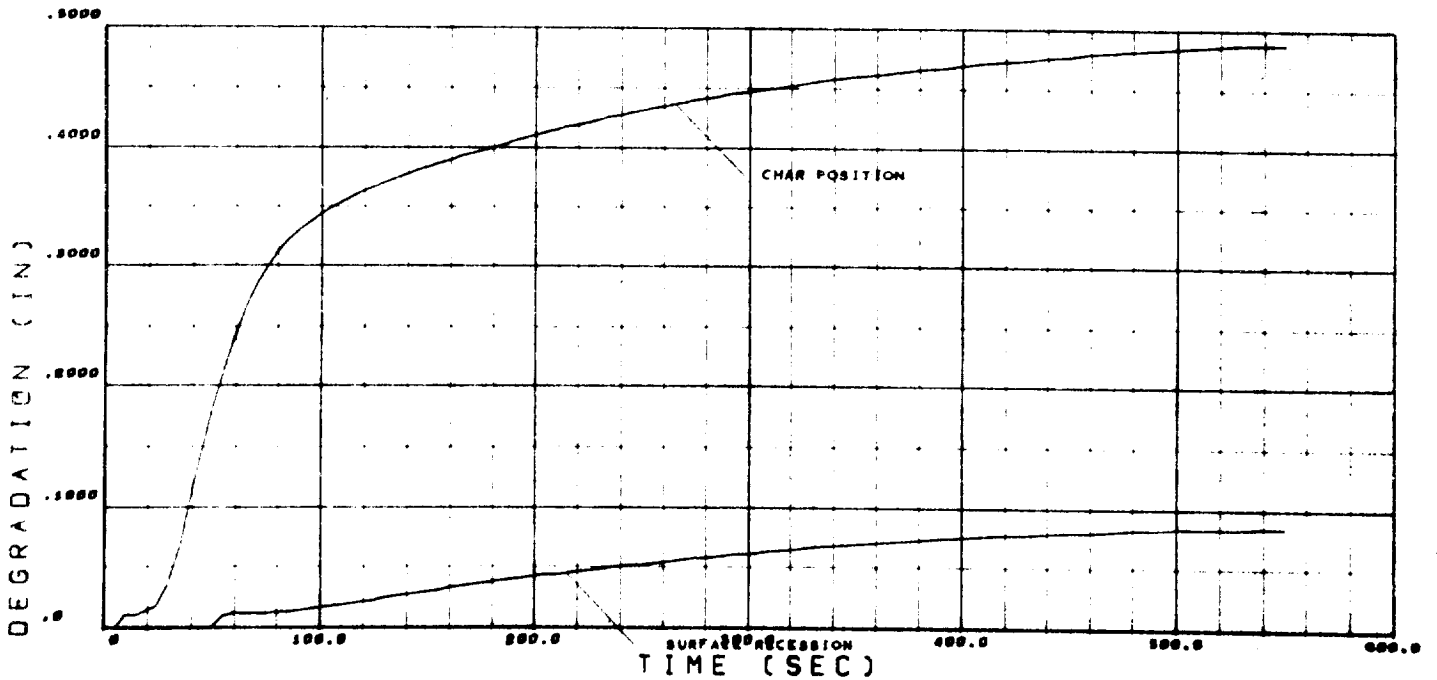
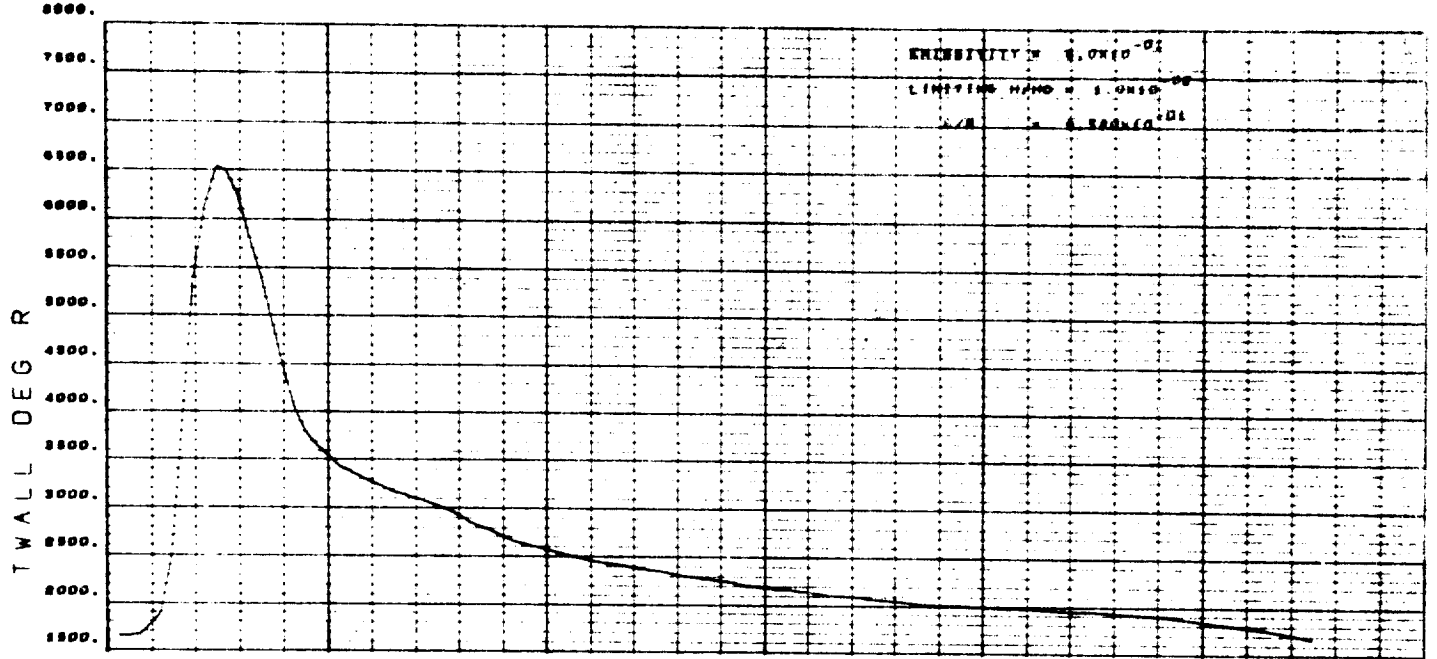


FIGURE A111

ENERGY ACCOMMODATION MECHANISMS

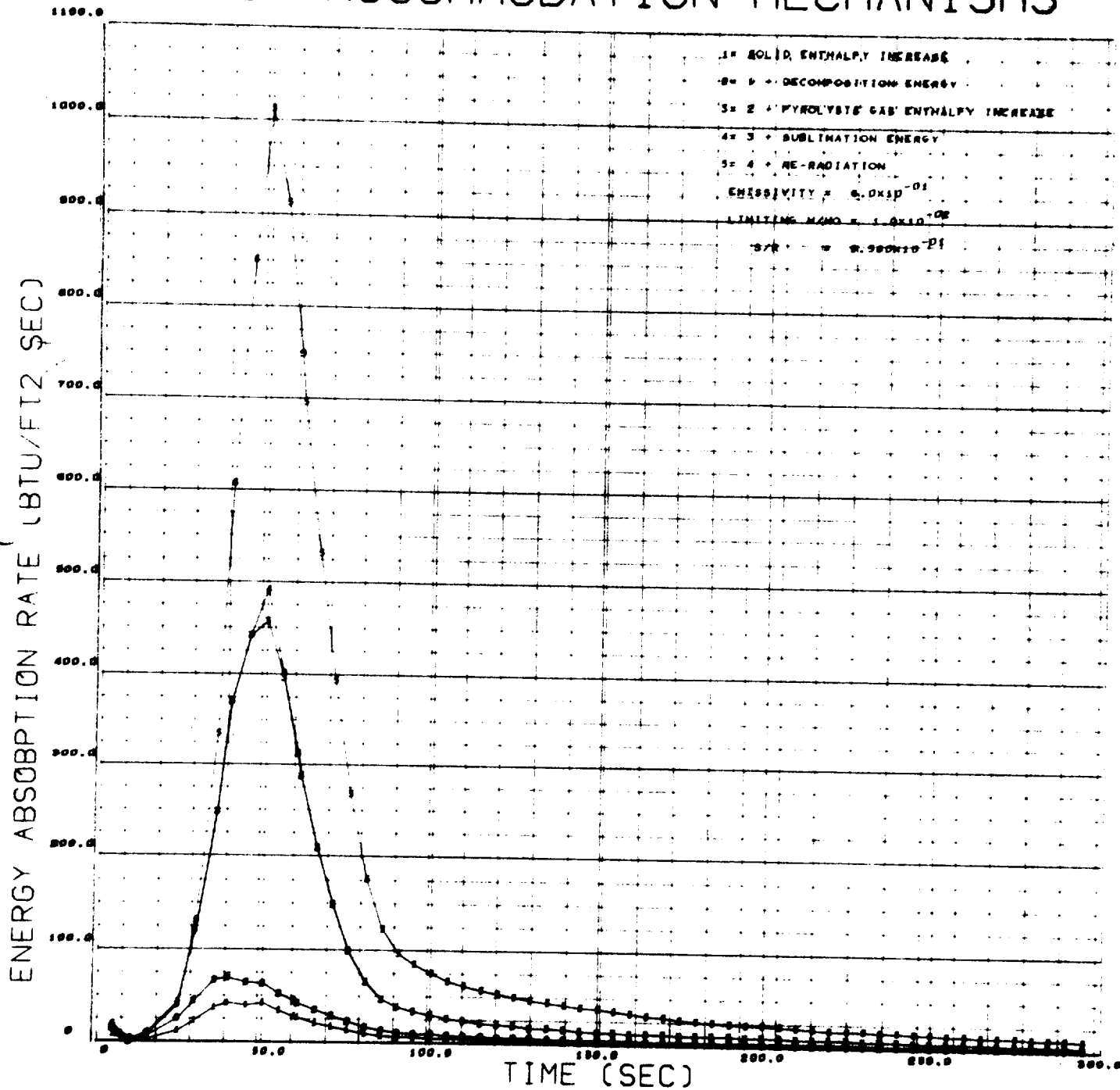


FIGURE A 112

HEATING RATE HISTORY

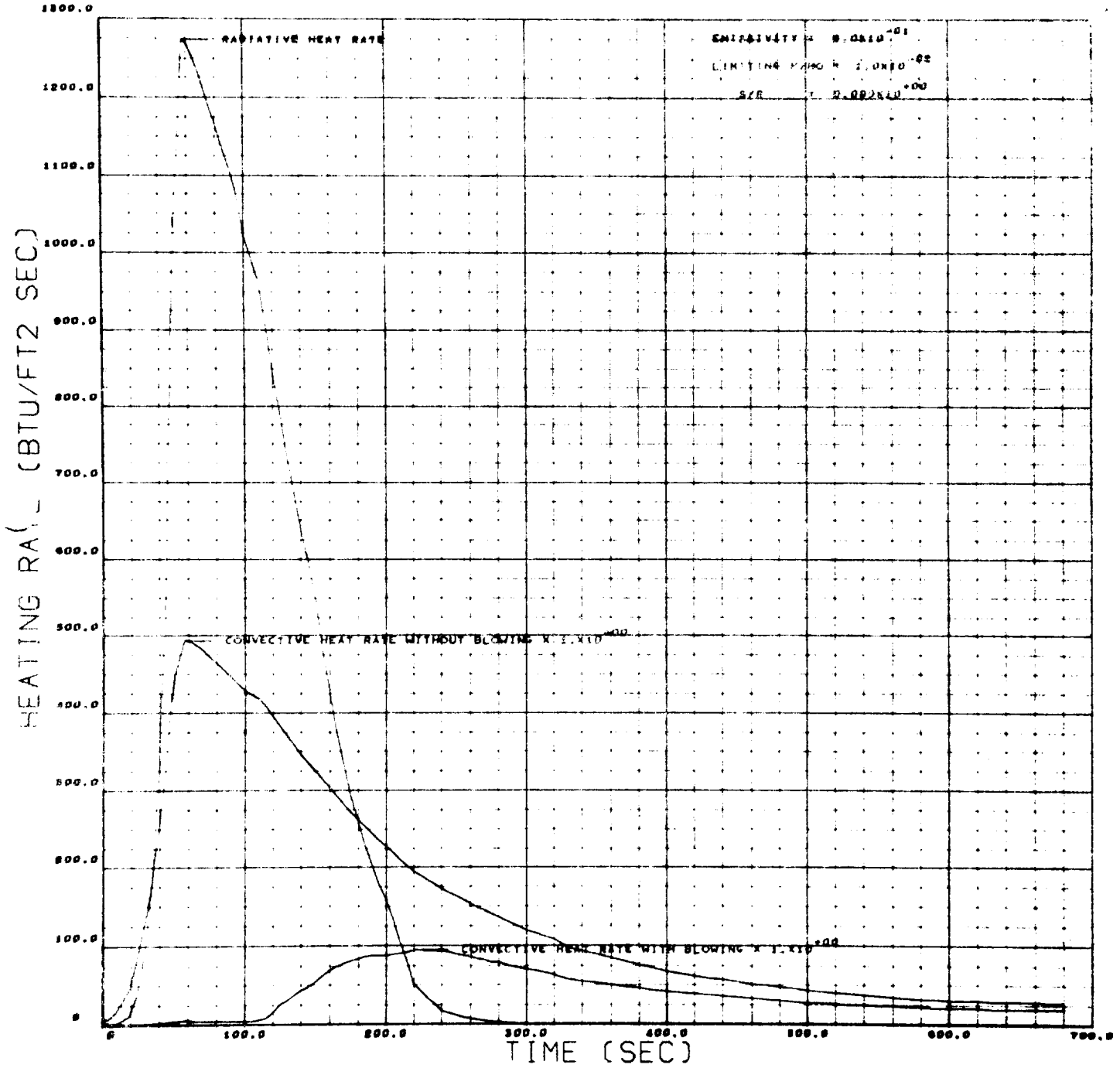


FIGURE A112

MATERIAL RESPONSE DATA

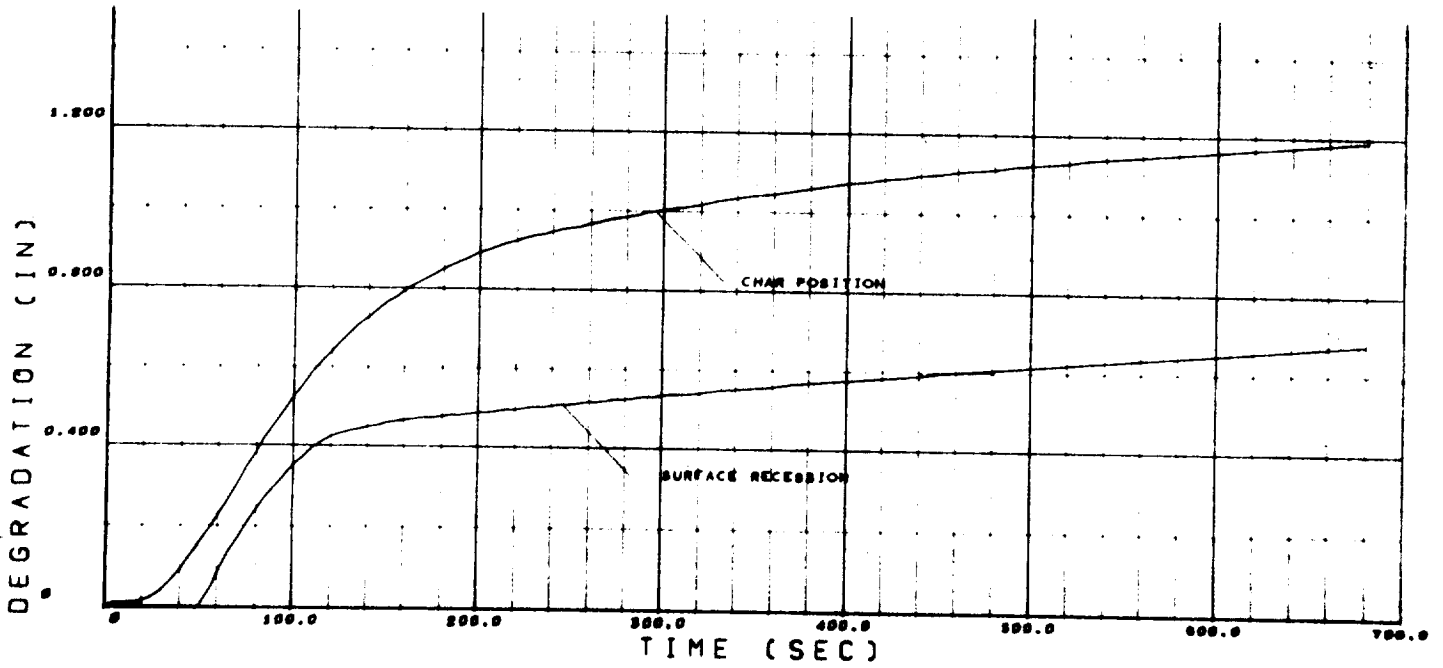
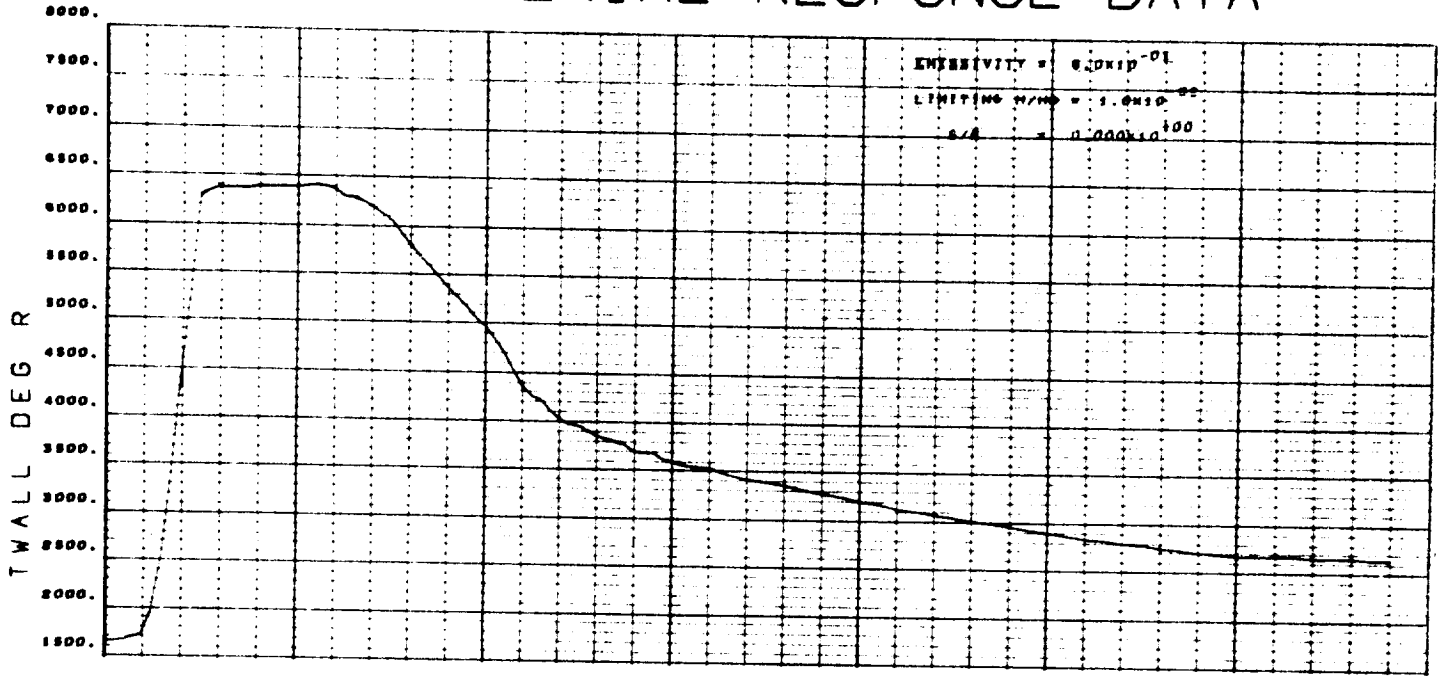


FIGURE A112

ENERGY ACCOMMODATION MECHANISMS

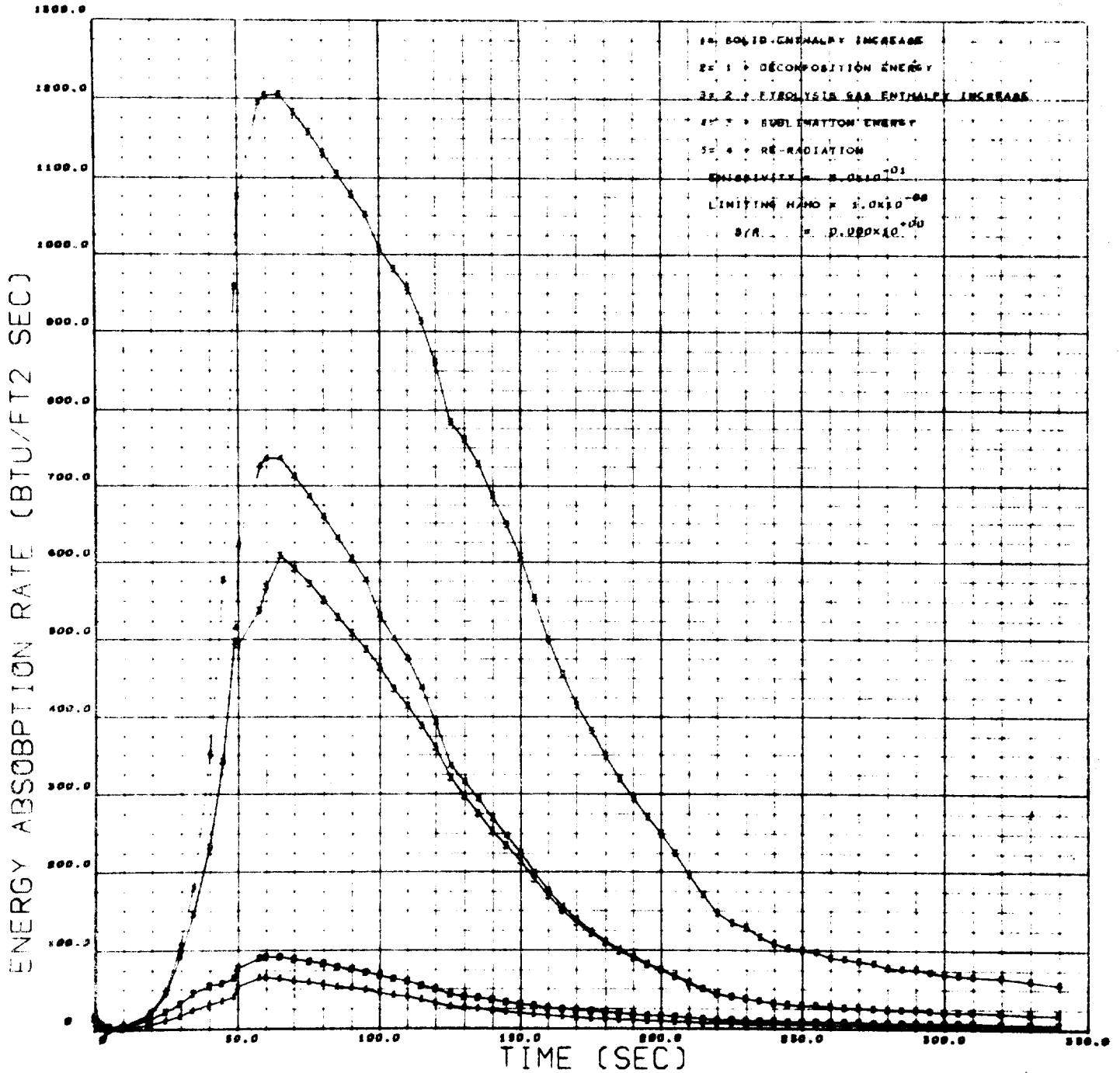


FIGURE A 113

HEATING RATE HISTORY

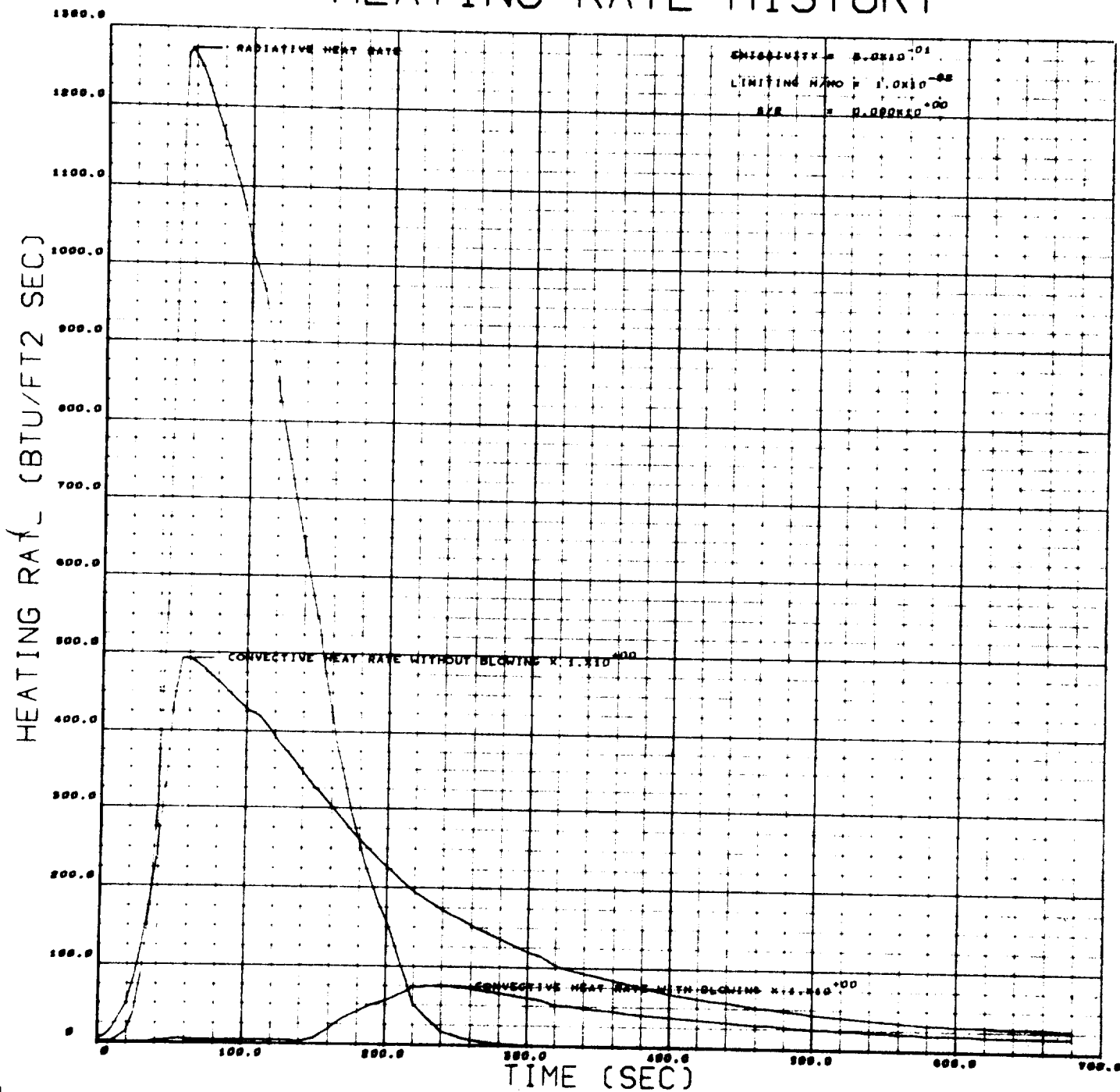


FIGURE A113

MATERIAL RESPONSE DATA

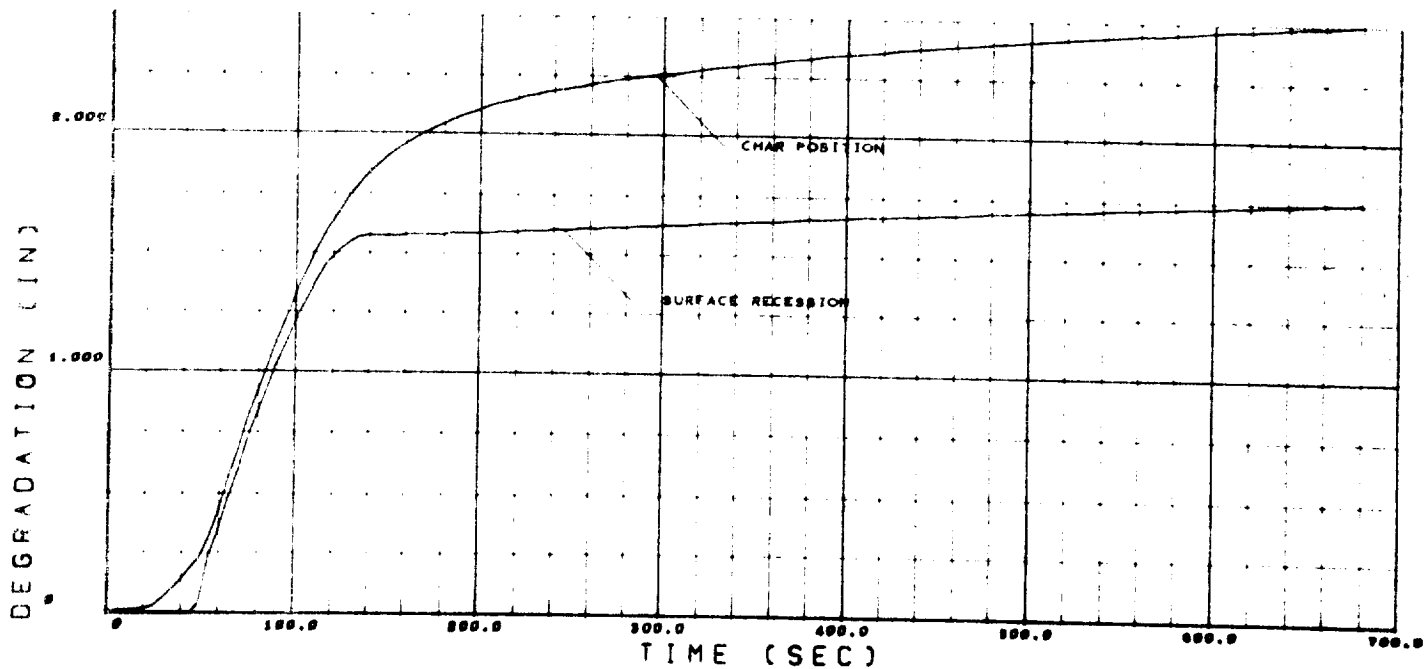
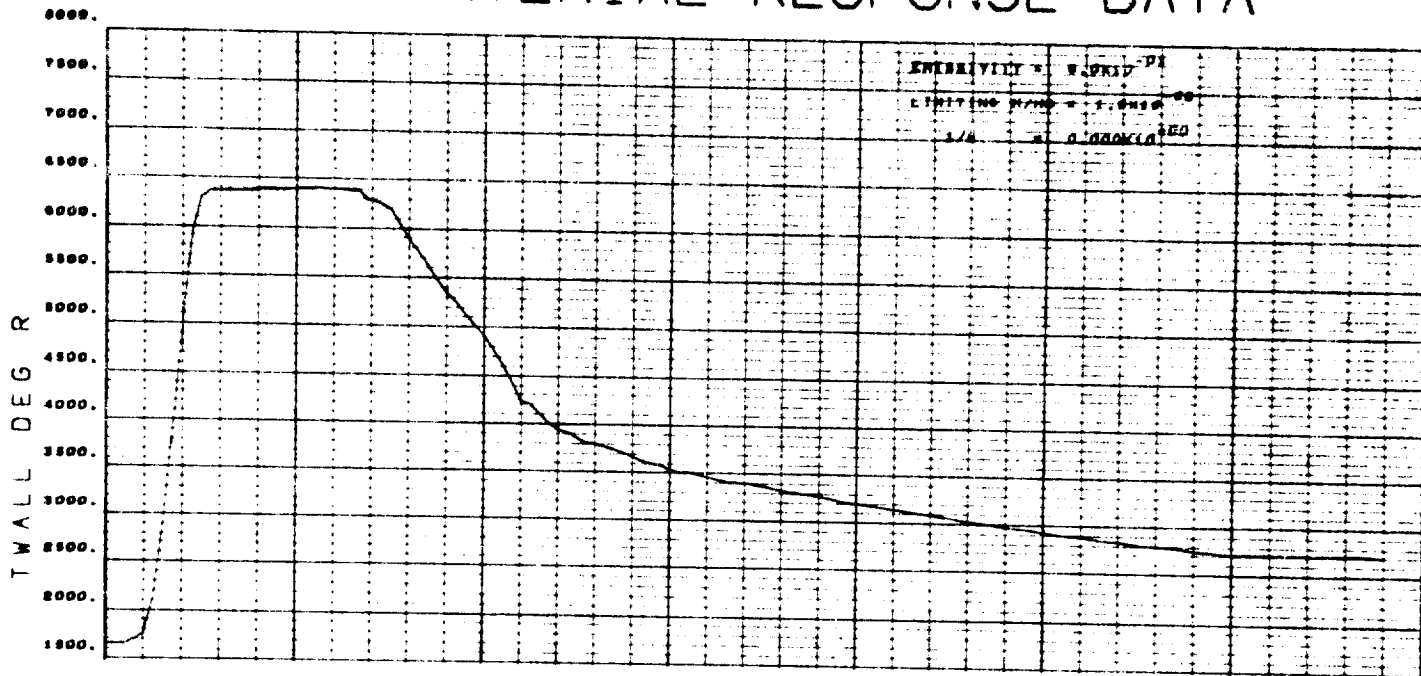


FIGURE A113

ENERGY ACCOMMODATION MECHANISMS

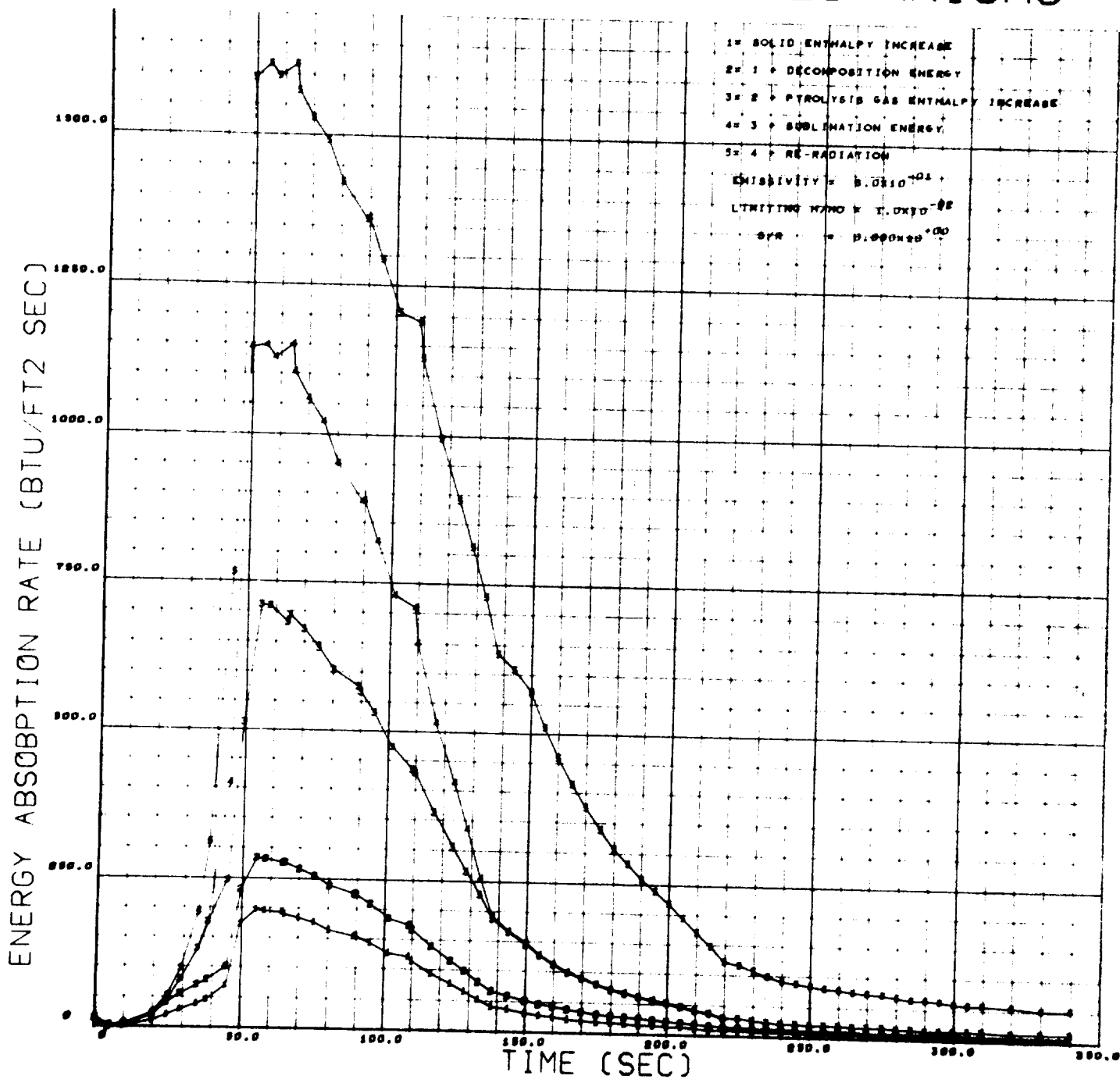


FIGURE A 114

HEATING RATE HISTORY

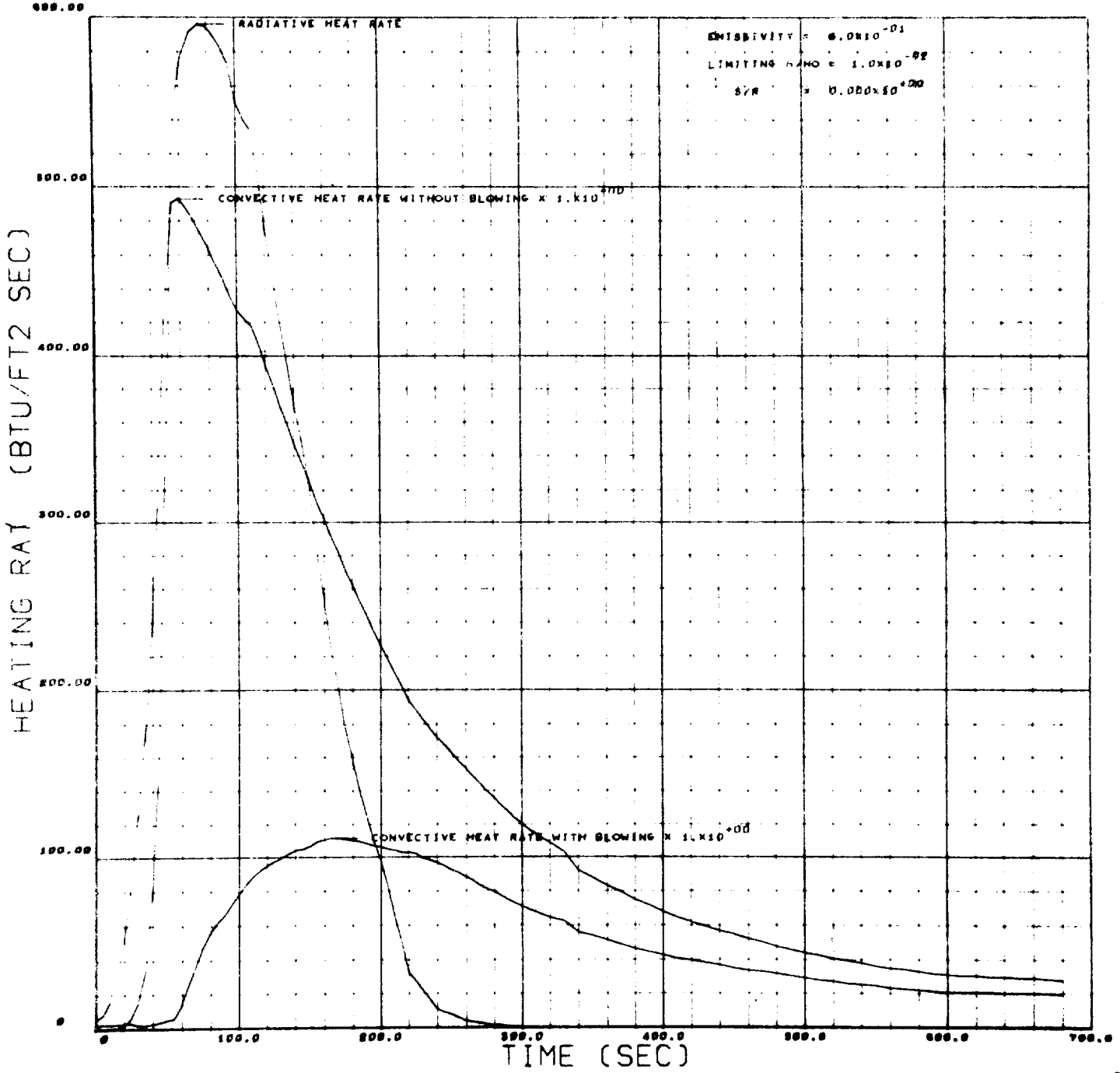


FIGURE A 114

MATERIAL RESPONSE DATA

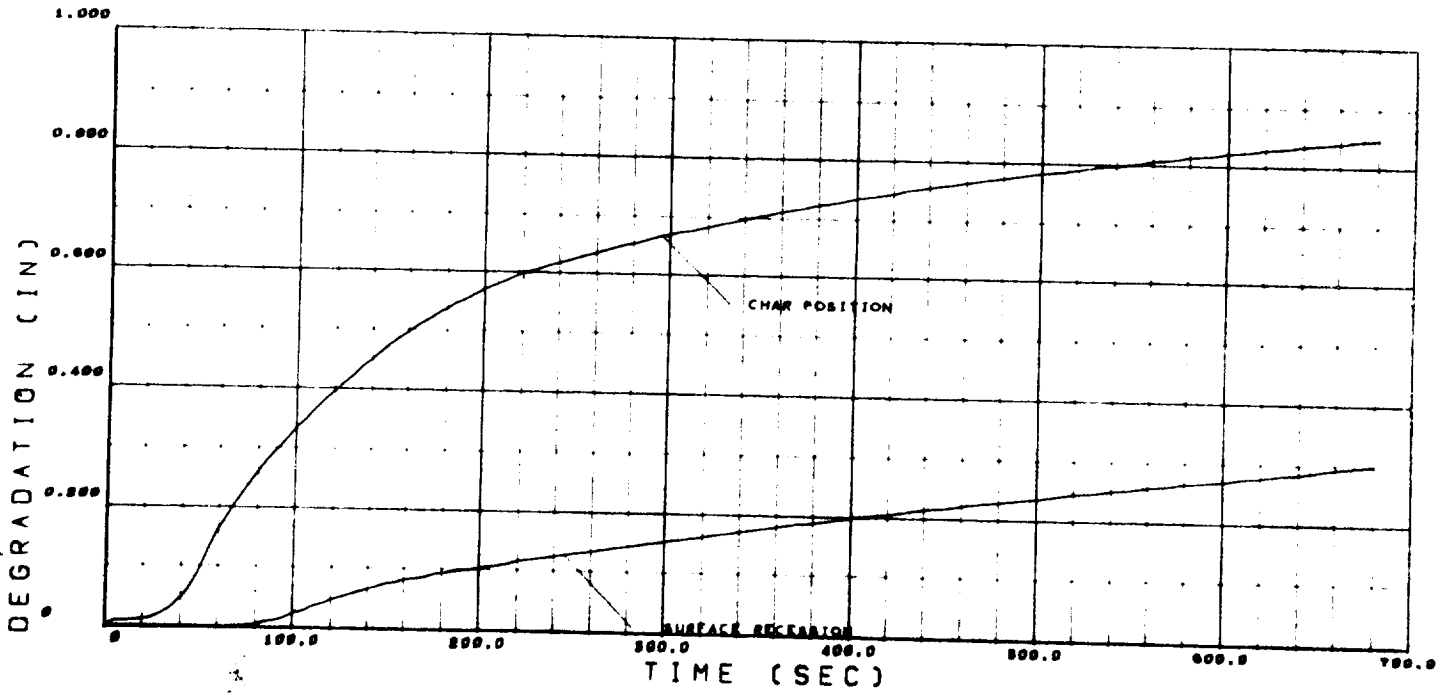
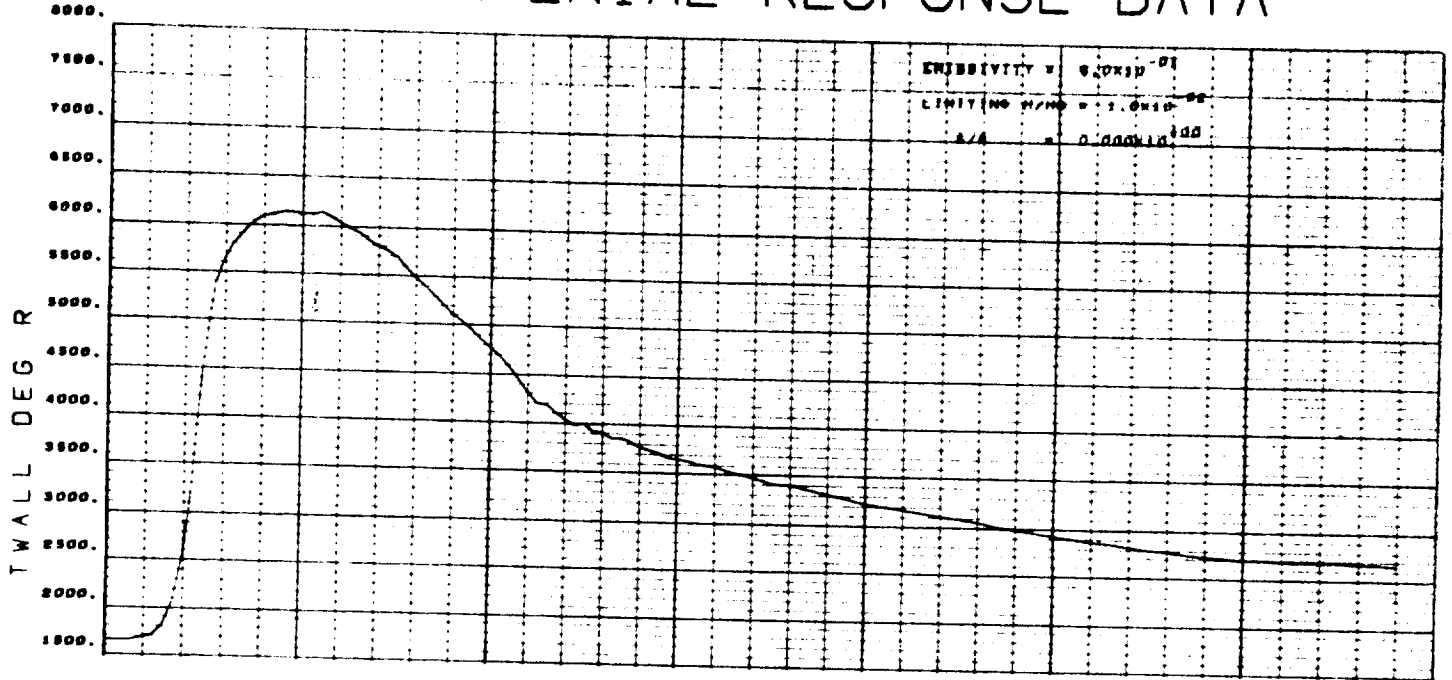


FIGURE A114

ENERGY ACCOMMODATION MECHANISMS

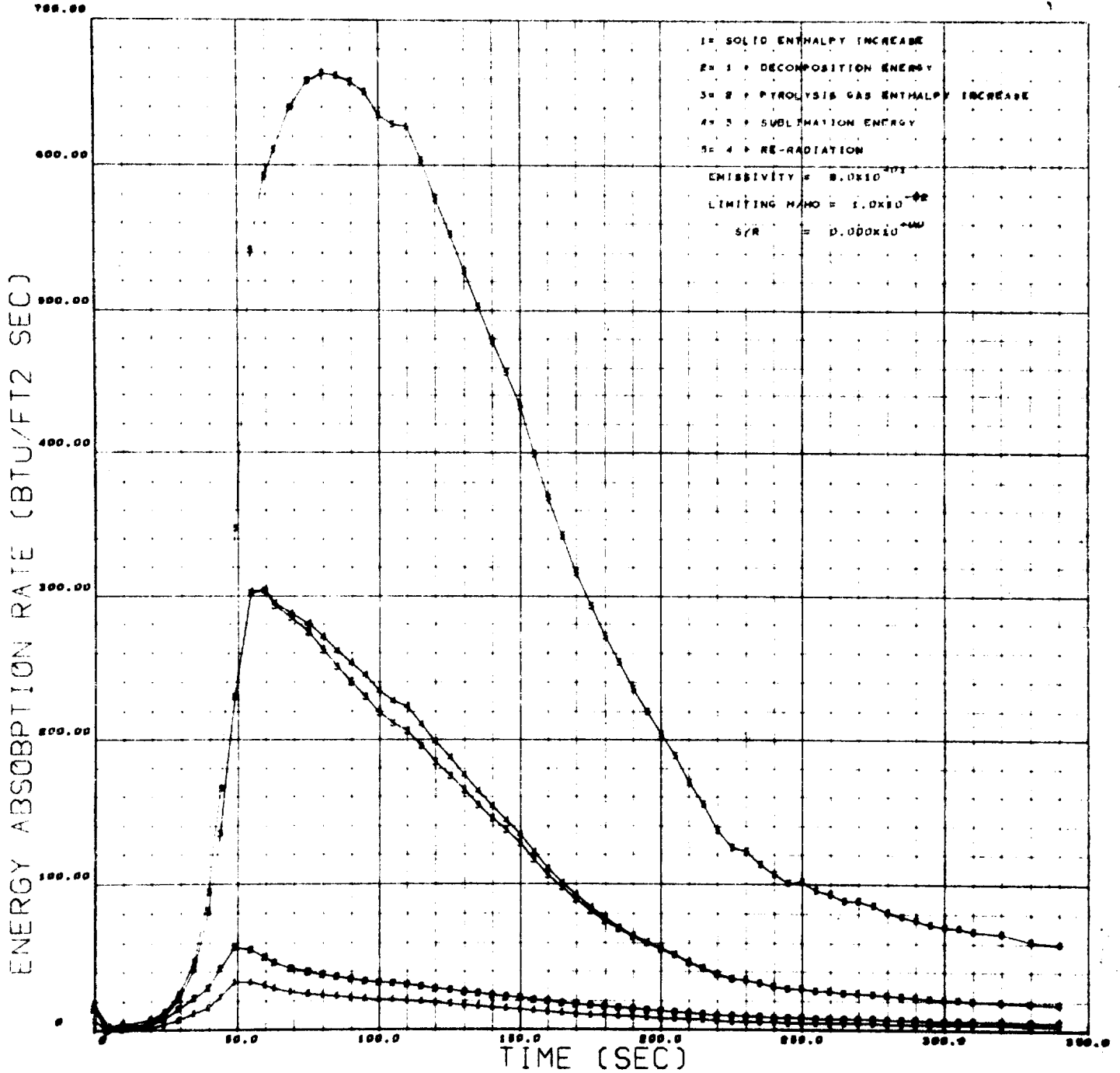


FIGURE A 115

HEATING RATE HISTORY

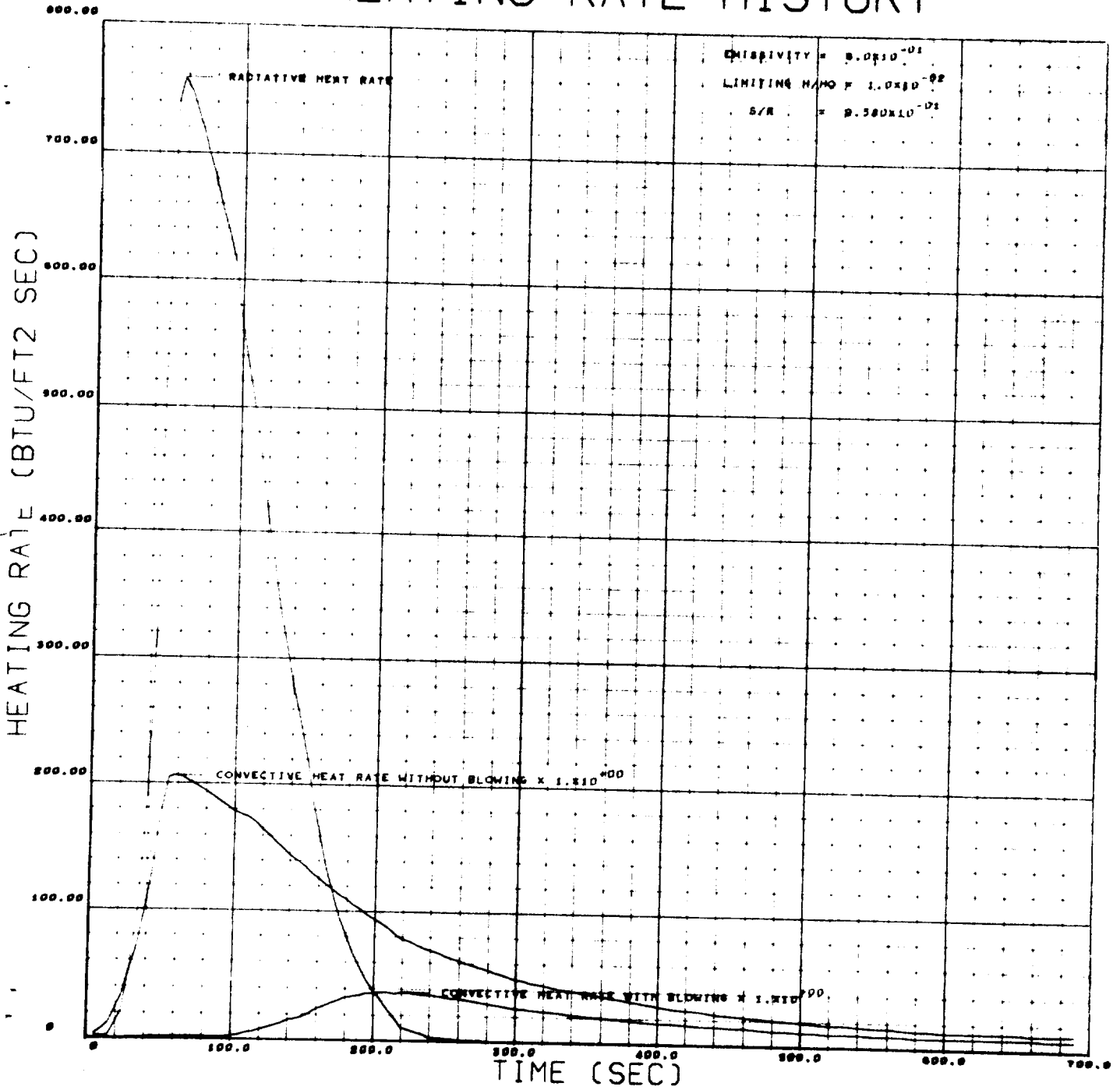


FIGURE A115

MATERIAL RESPONSE DATA

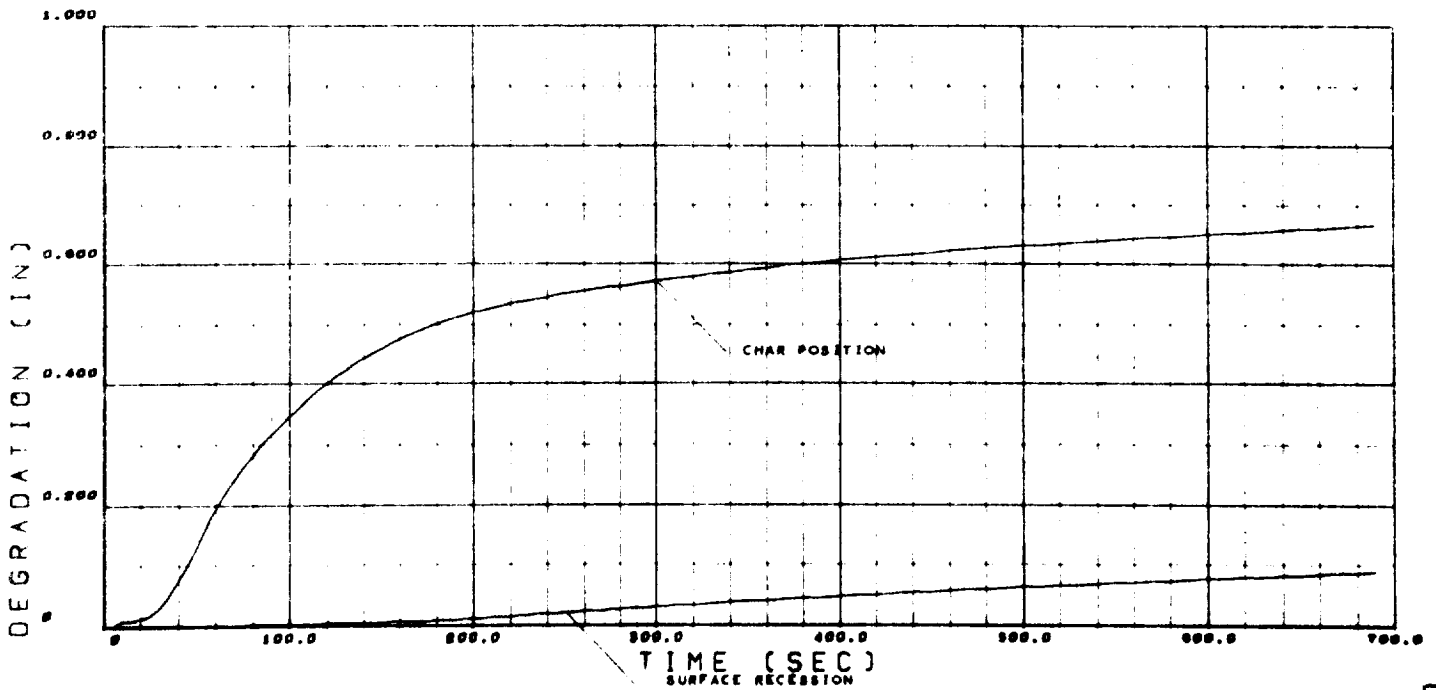
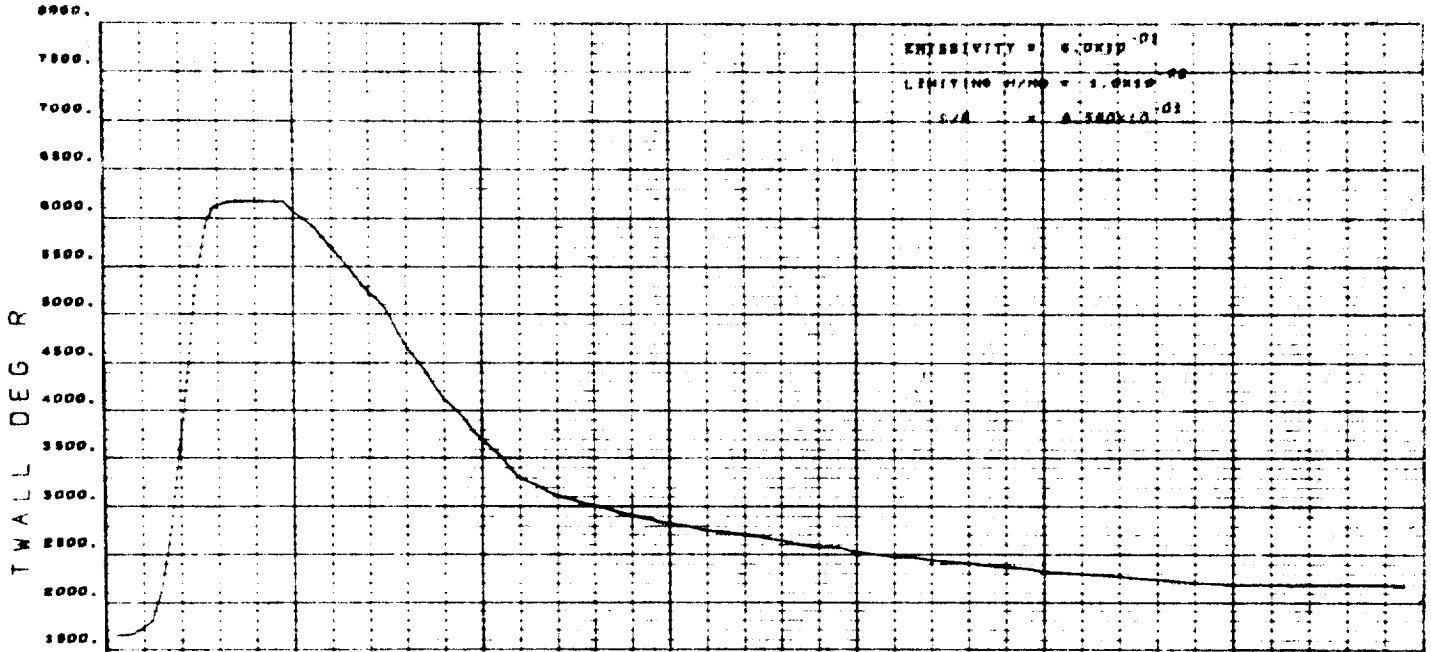


FIGURE A115

ENERGY ACCOMMODATION MECHANISMS

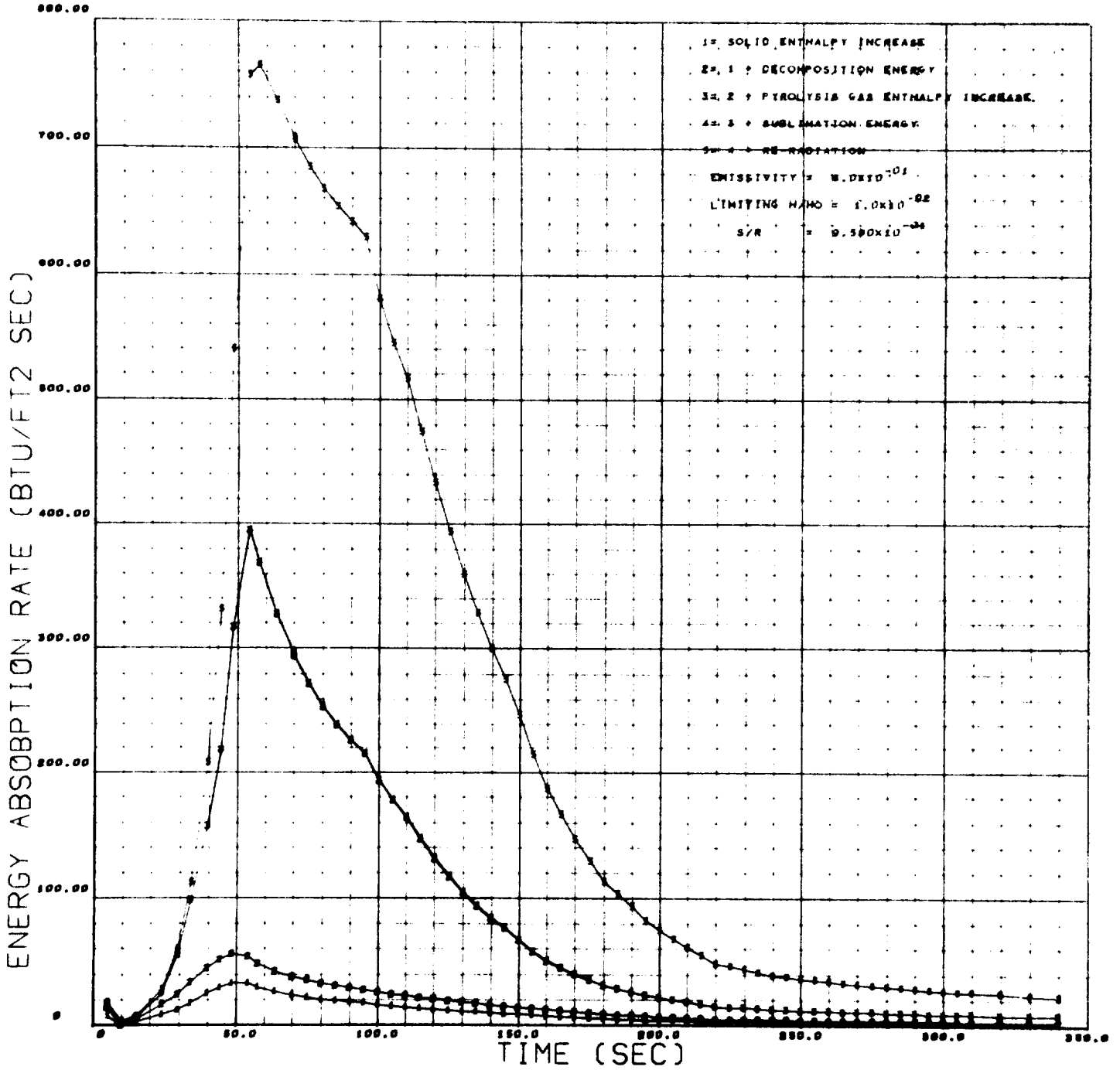


FIGURE A116

HEATING RATE HISTORY

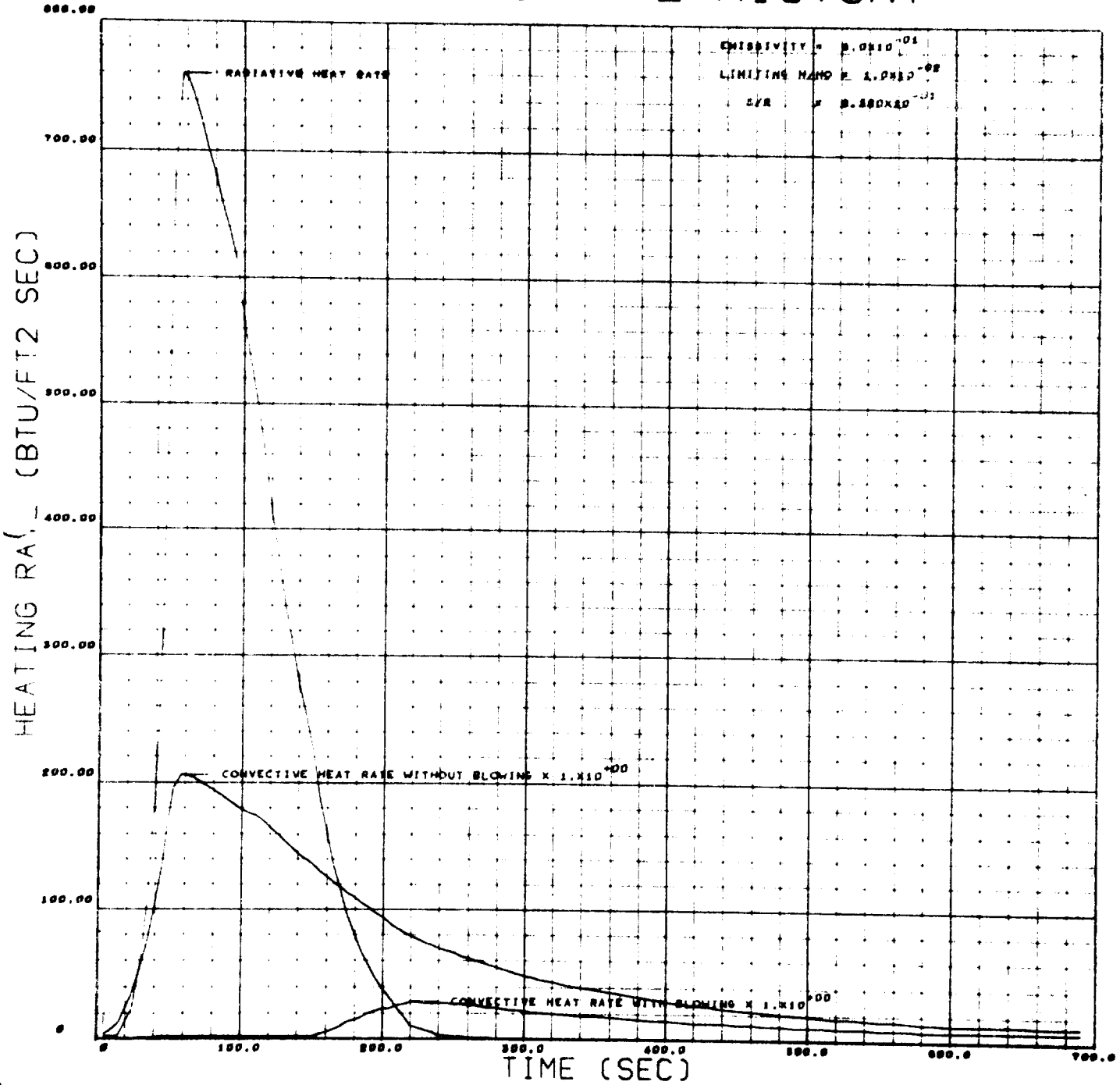


FIGURE A16

MATERIAL RESPONSE DATA

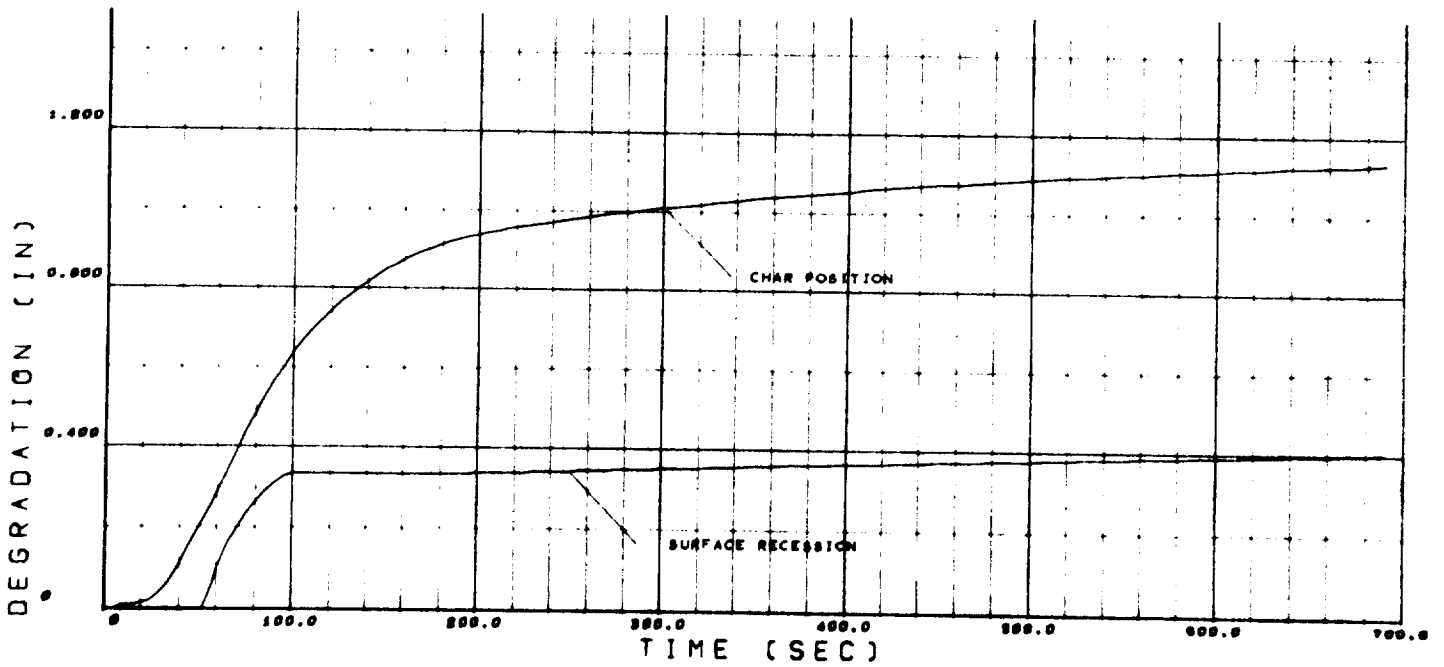
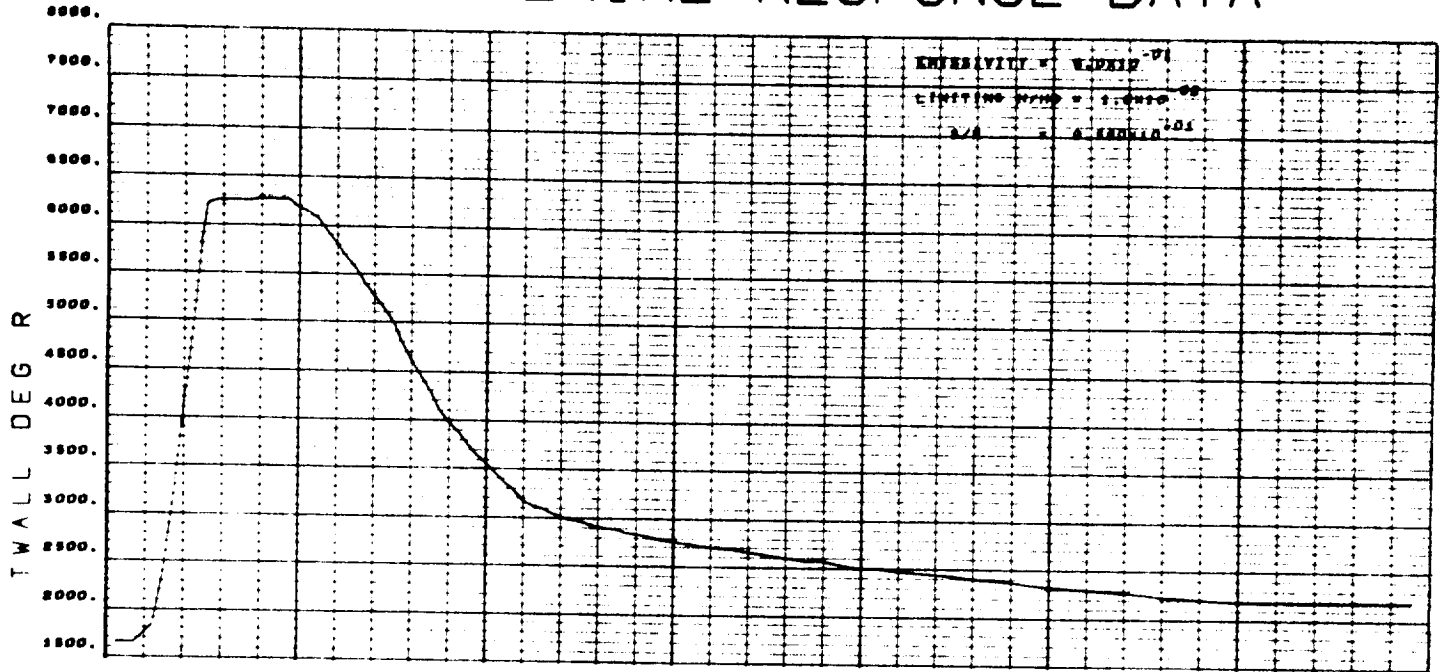


FIGURE A116

ENERGY ACCOMMODATION MECHANISMS

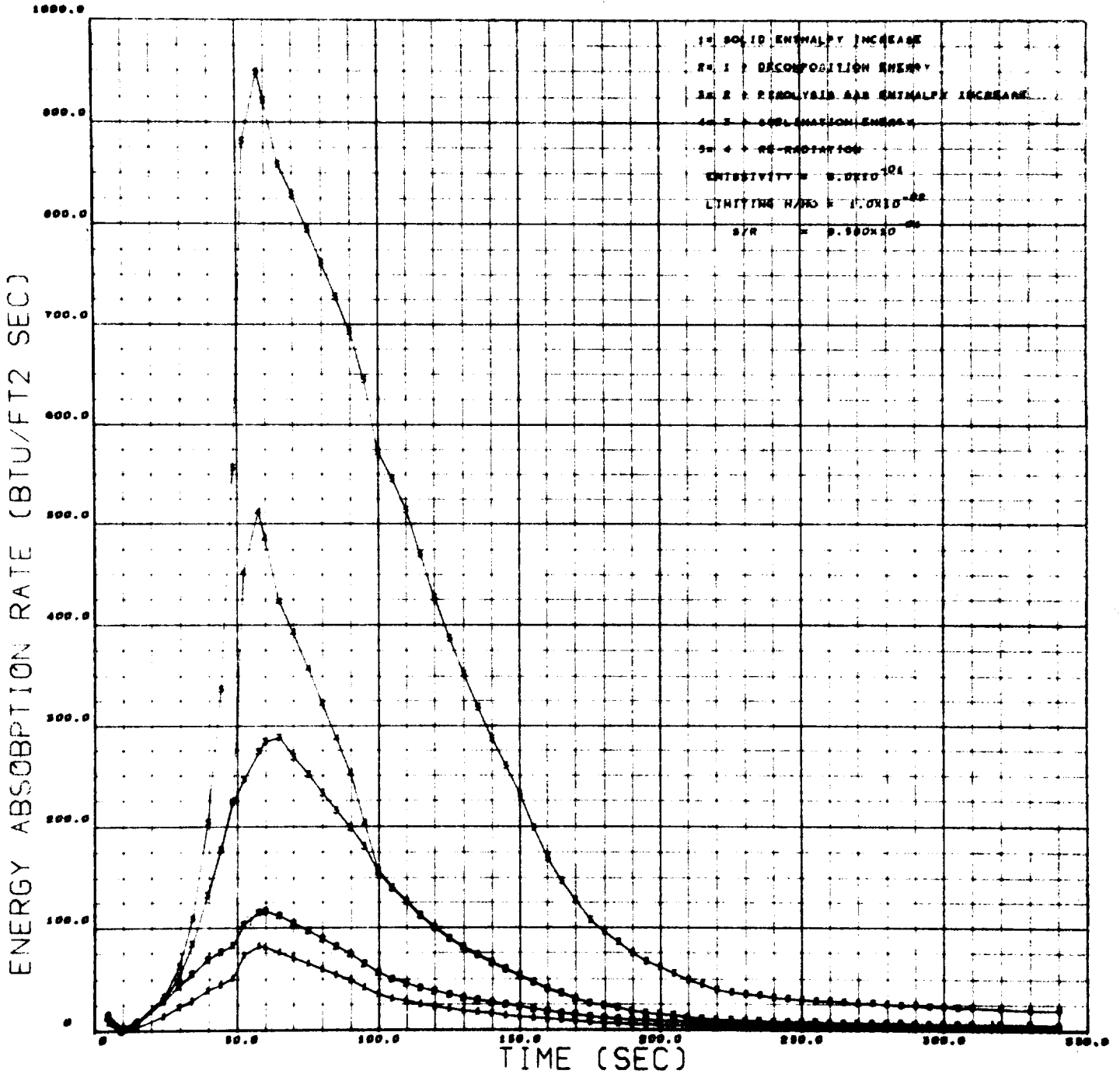


FIGURE A117

HEATING RATE HISTORY

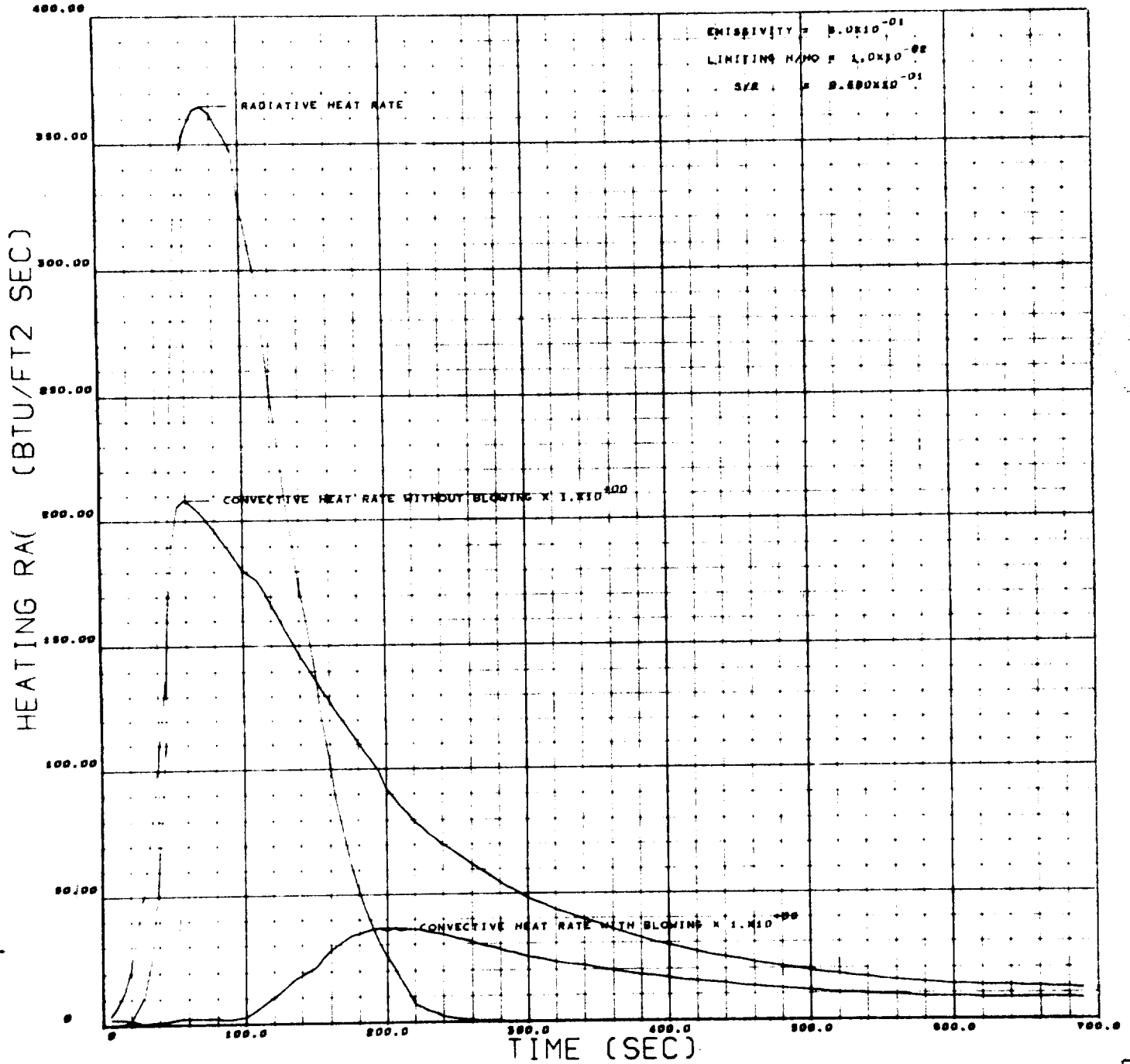
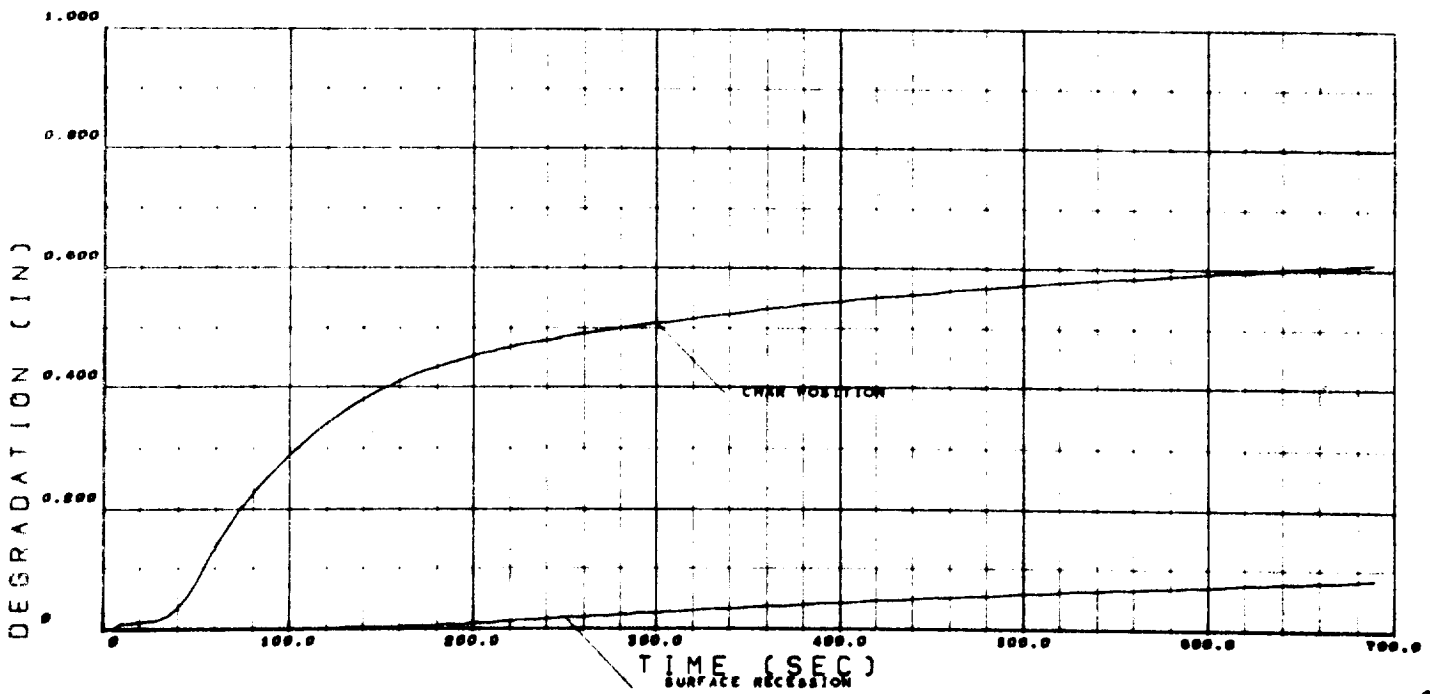
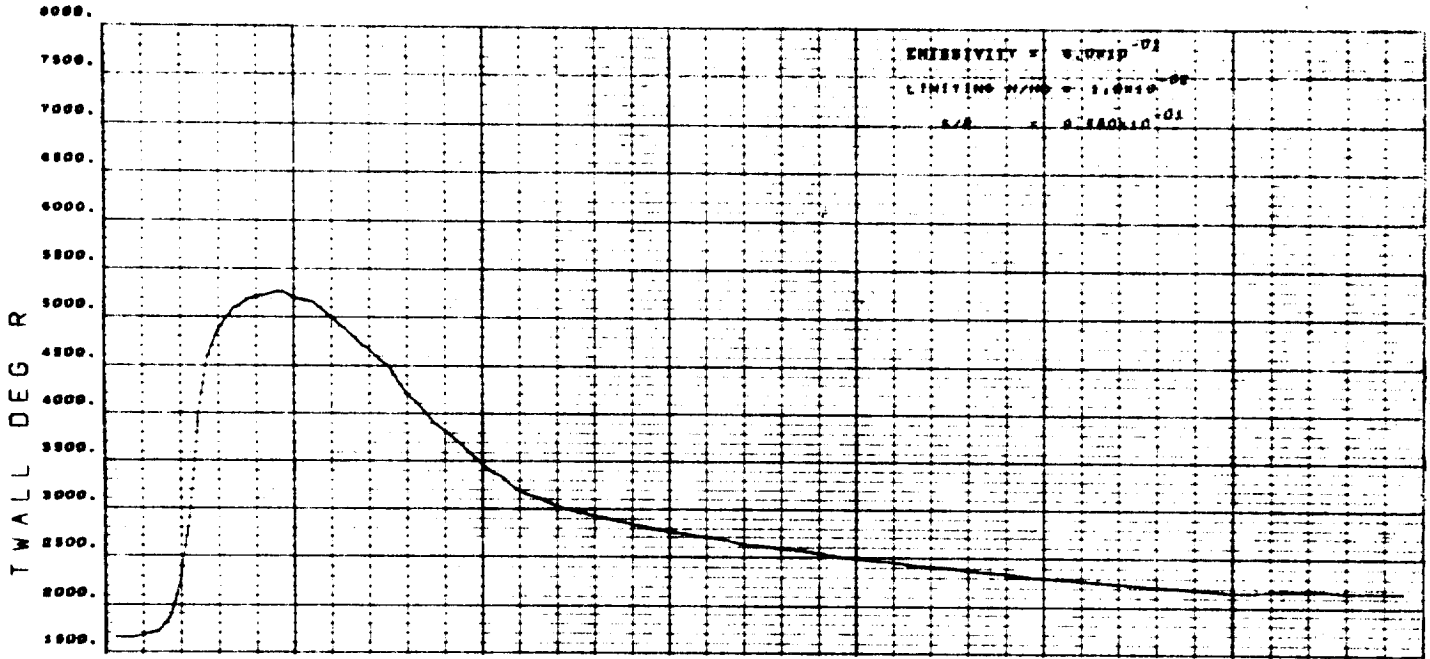


FIGURE A117

MATERIAL RESPONSE DATA



350

FIGURE A117

ENERGY ACCOMMODATION MECHANISMS

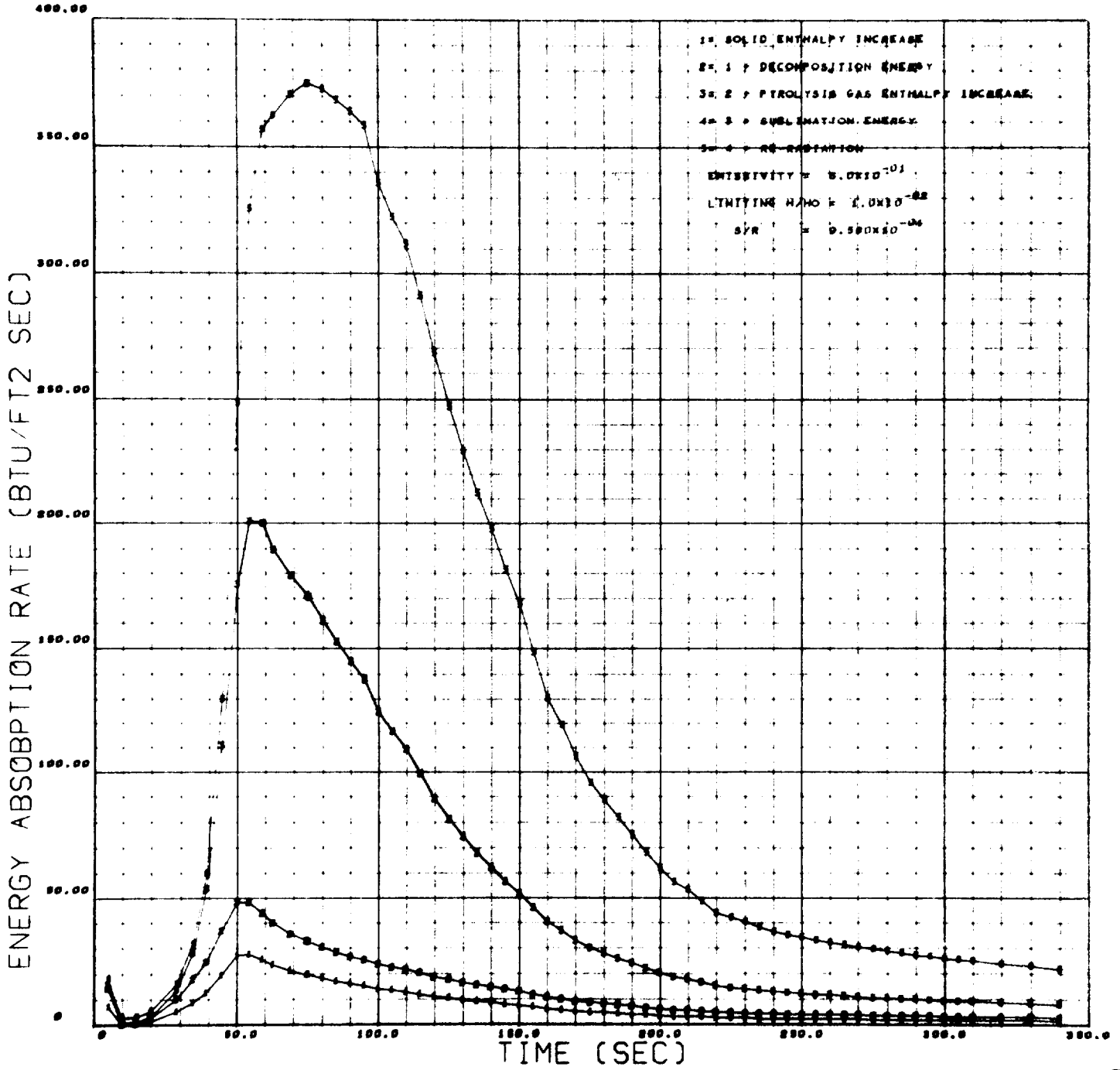


FIGURE B1

HEATING RATE HISTORY

LOWER BOUNDARY - VE=45000 - TRAJECTORY LB-46 AND LB-47

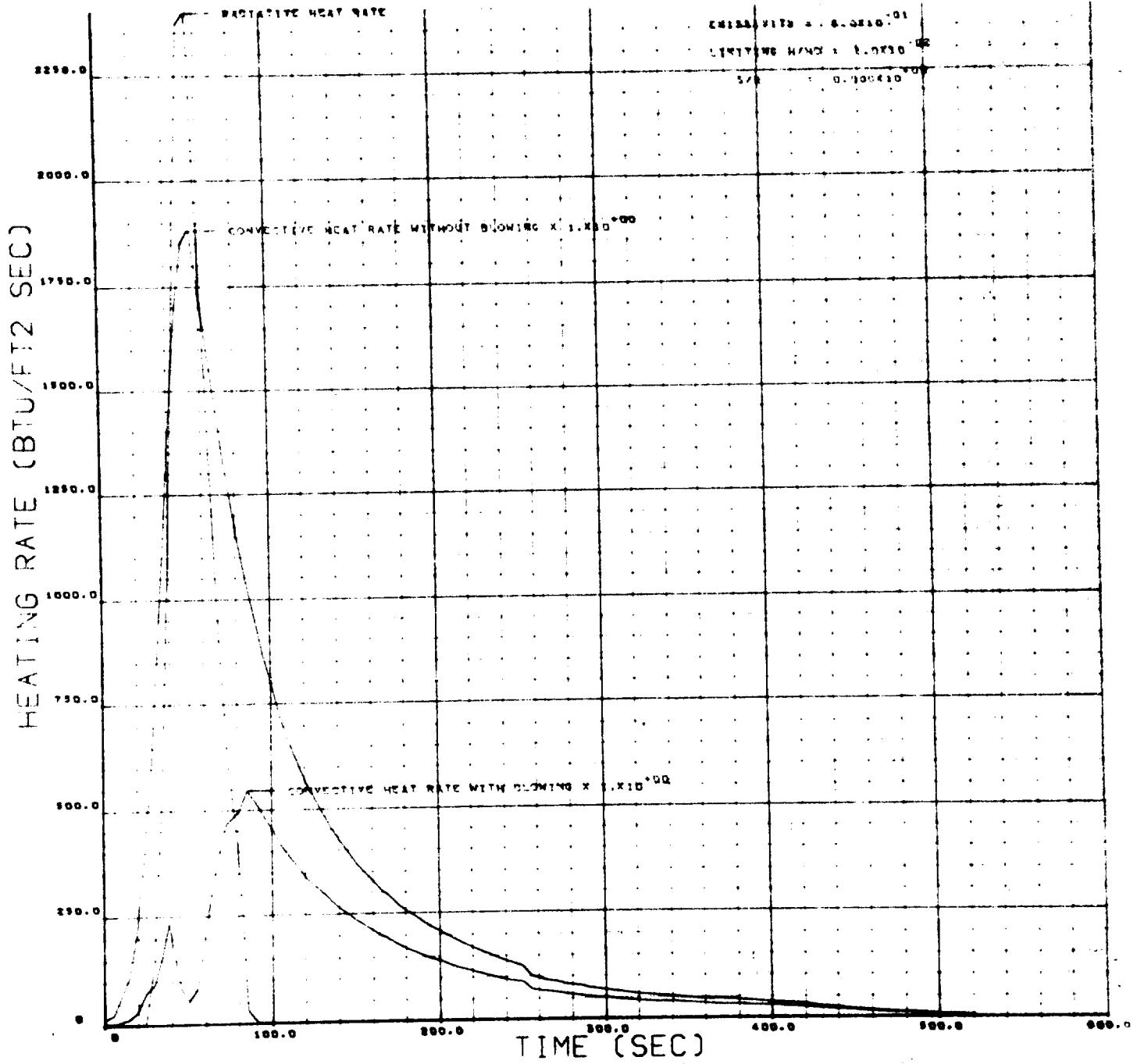


FIGURE B1

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VE=45000 - TRAJECTORY LB-46 AND LB-47

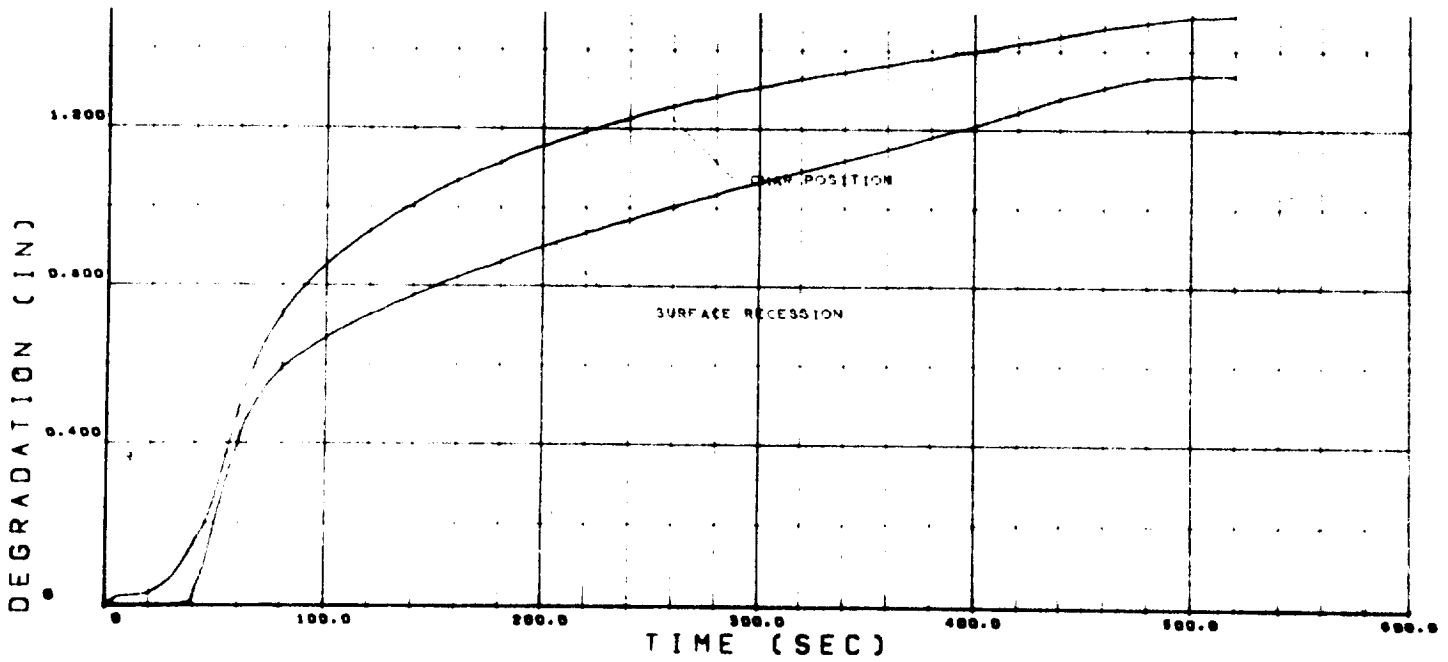
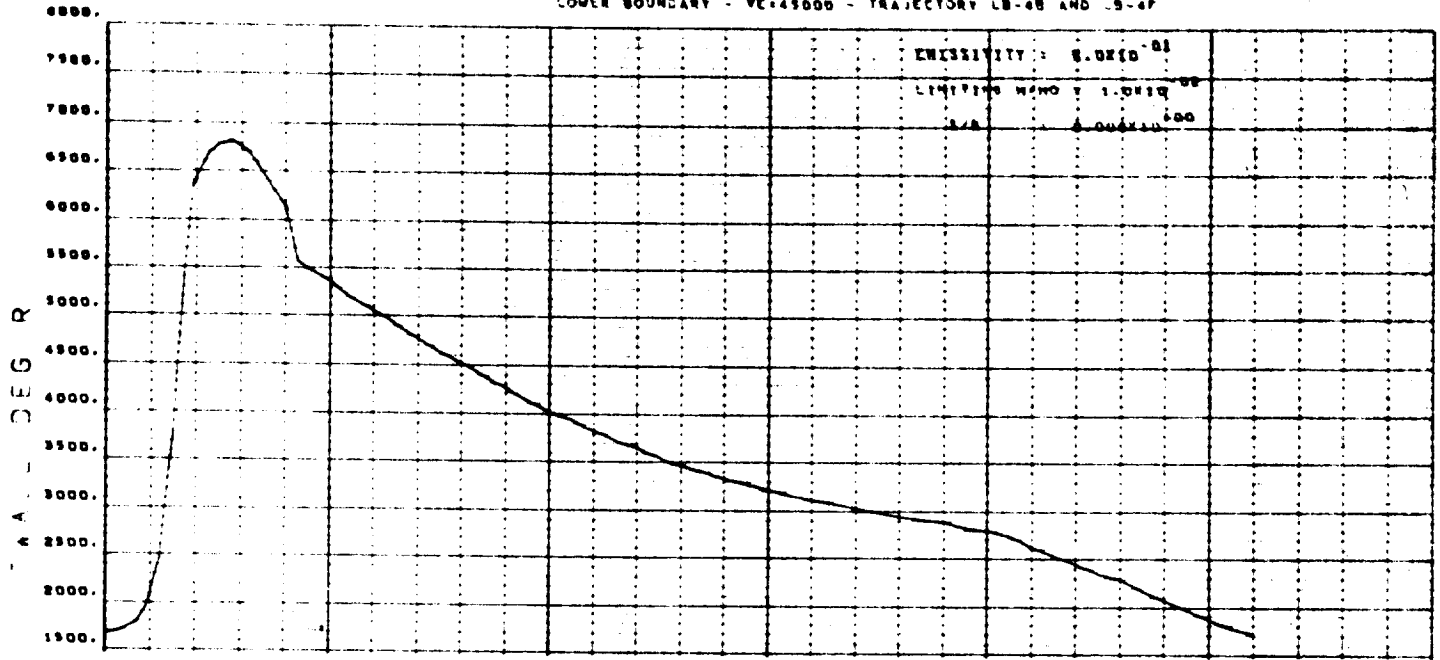


FIGURE B1

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=45000 - TRAJECTORY LB-48 AND LB-47

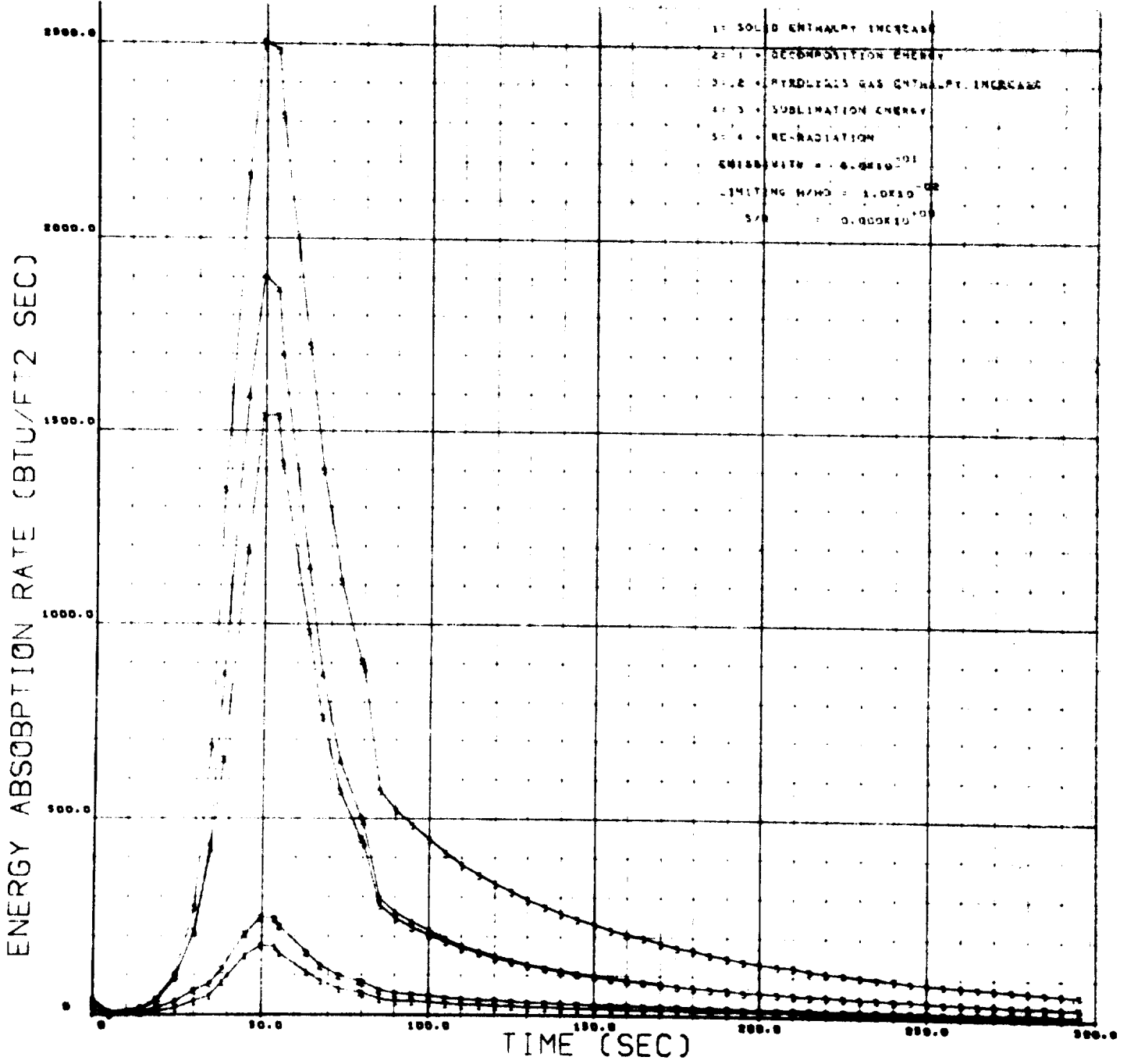


FIGURE B2

HEATING RATE HISTORY

LOWER BOUNDARY - VC-49000 - TRAJECTORY LB-40 AND LB-47

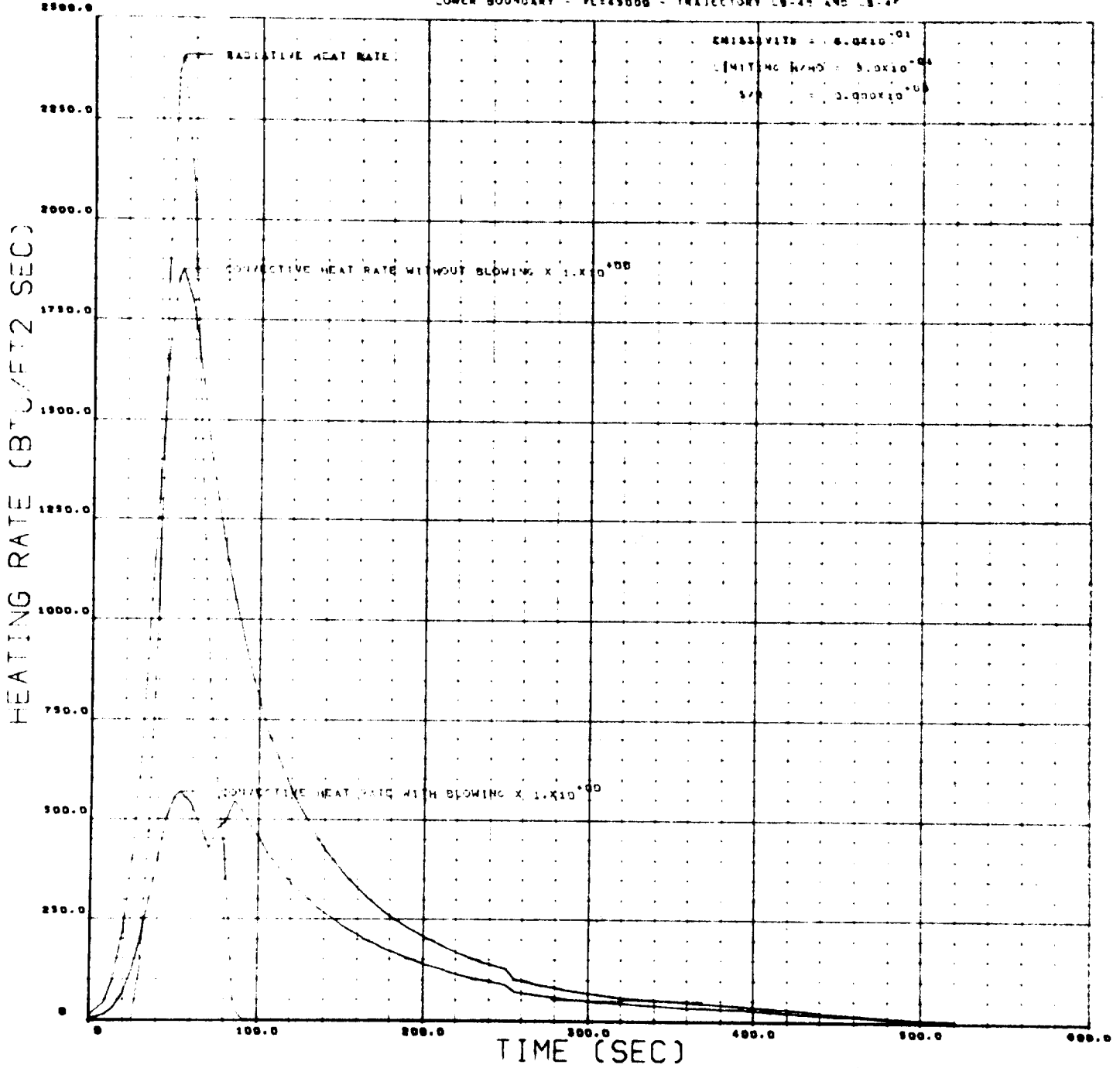


FIGURE 32

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VE: 49000 - TRAJECTORY: 2-48 AND 5-47

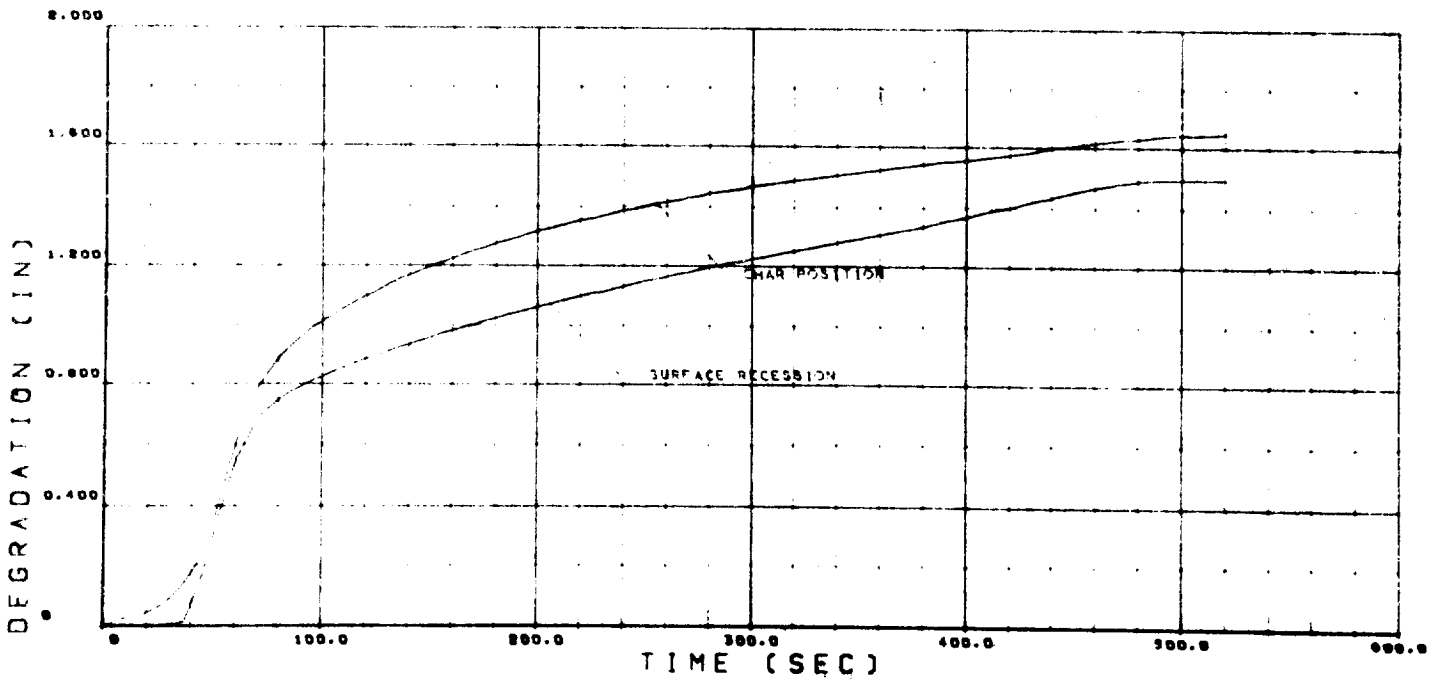
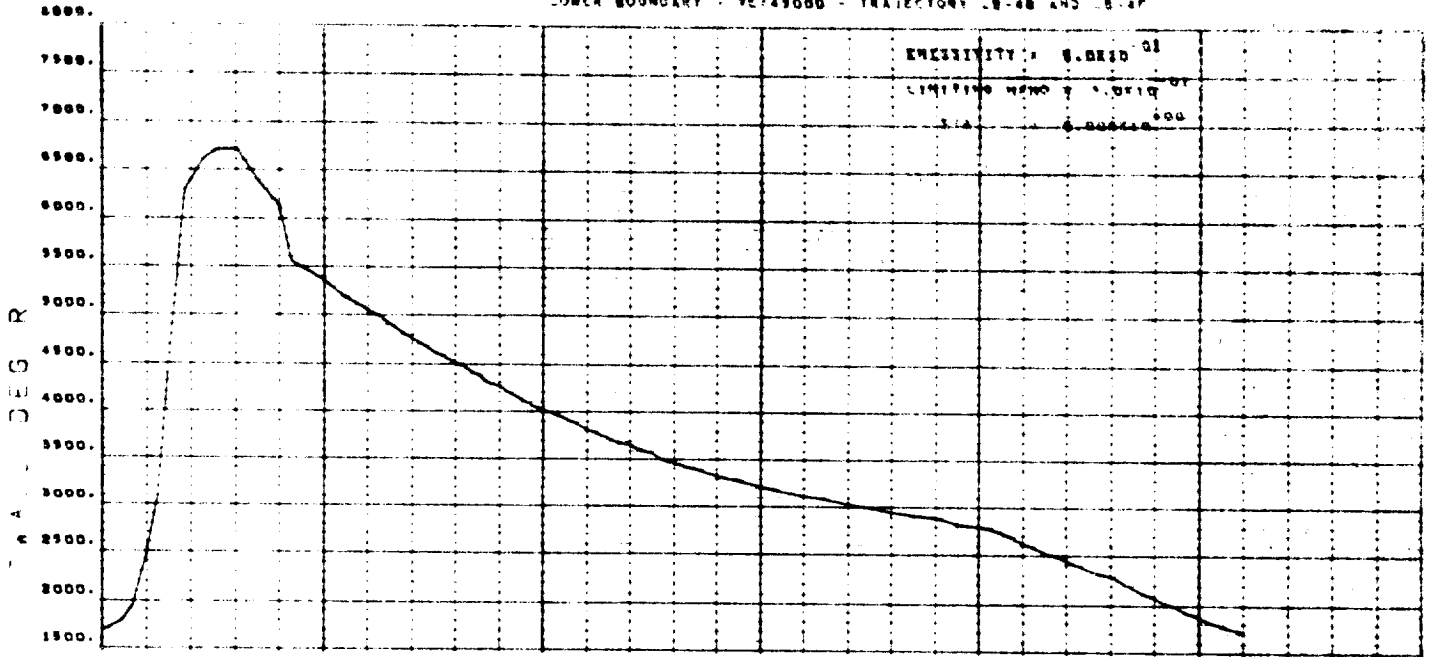


FIGURE 32

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=45000 - TRAJECTORY LB-48 AND LB-47

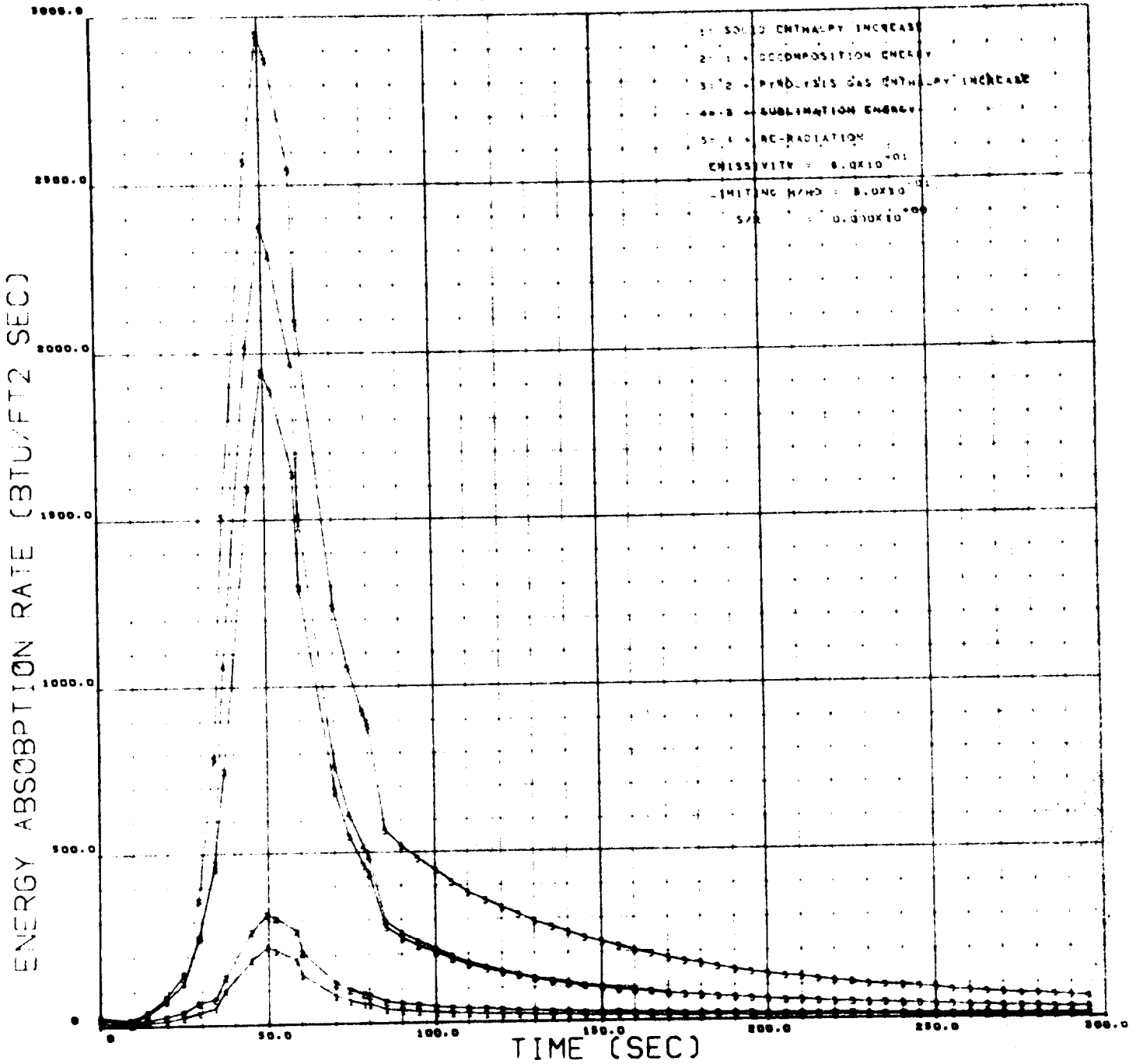


FIGURE B3

HEATING RATE HISTORY

LOWER BOUNDARY - VE=45000 - TRAJECTORY LB-40 AND LB-47

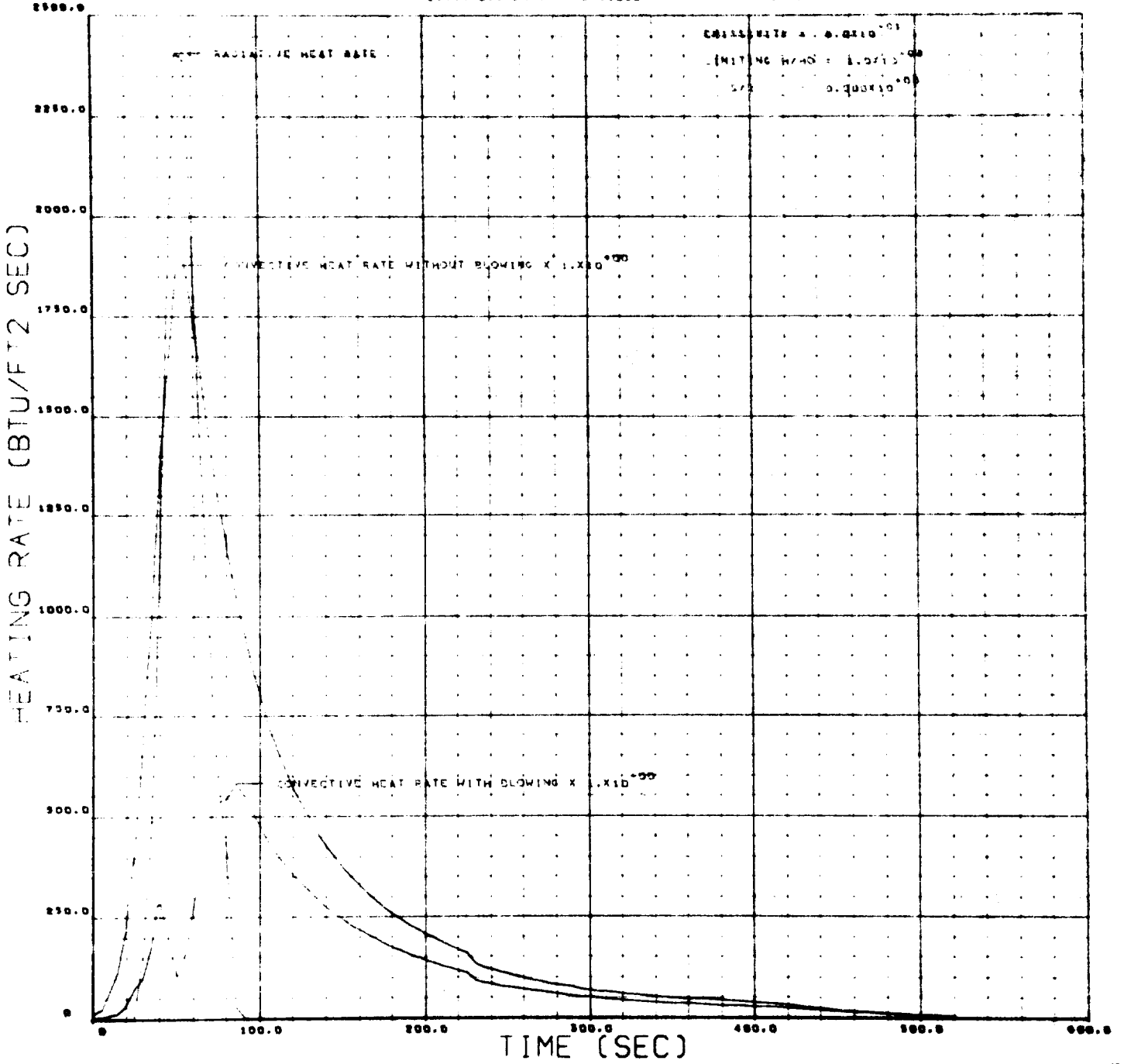


FIGURE B3

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=45000 - TRAJECTORY LB-46 AND LB-47

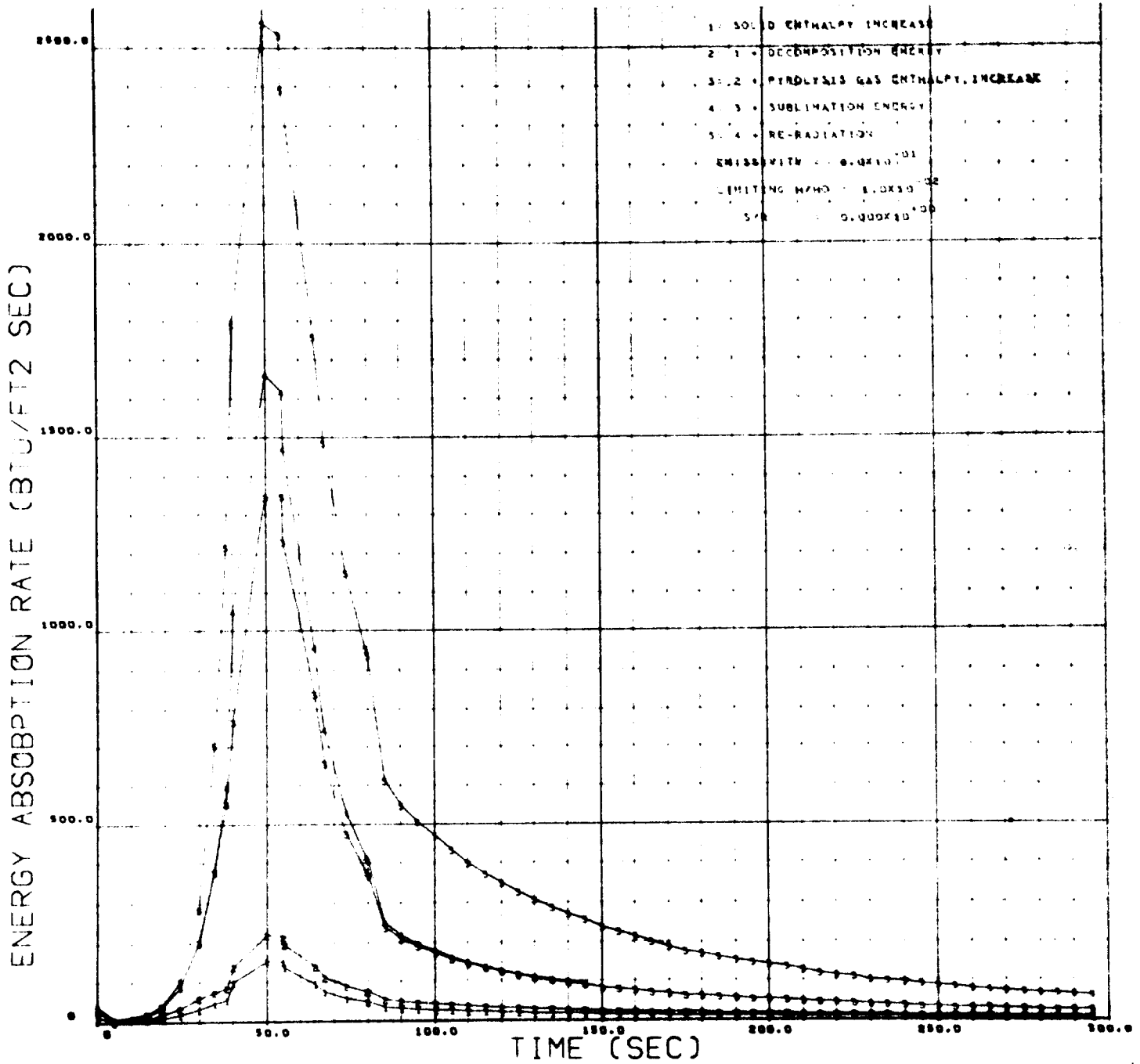


FIGURE 53

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VE=45000 - TRAJECTORY C8-48 AND C8-47

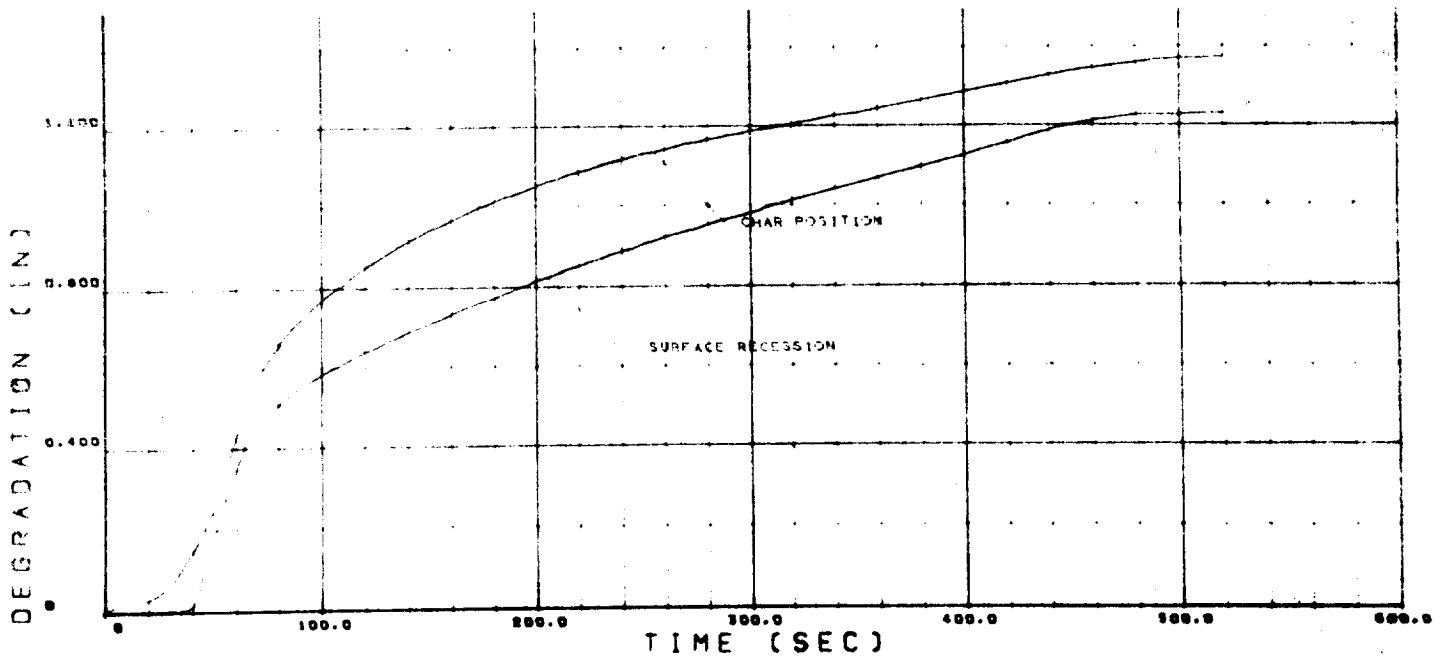
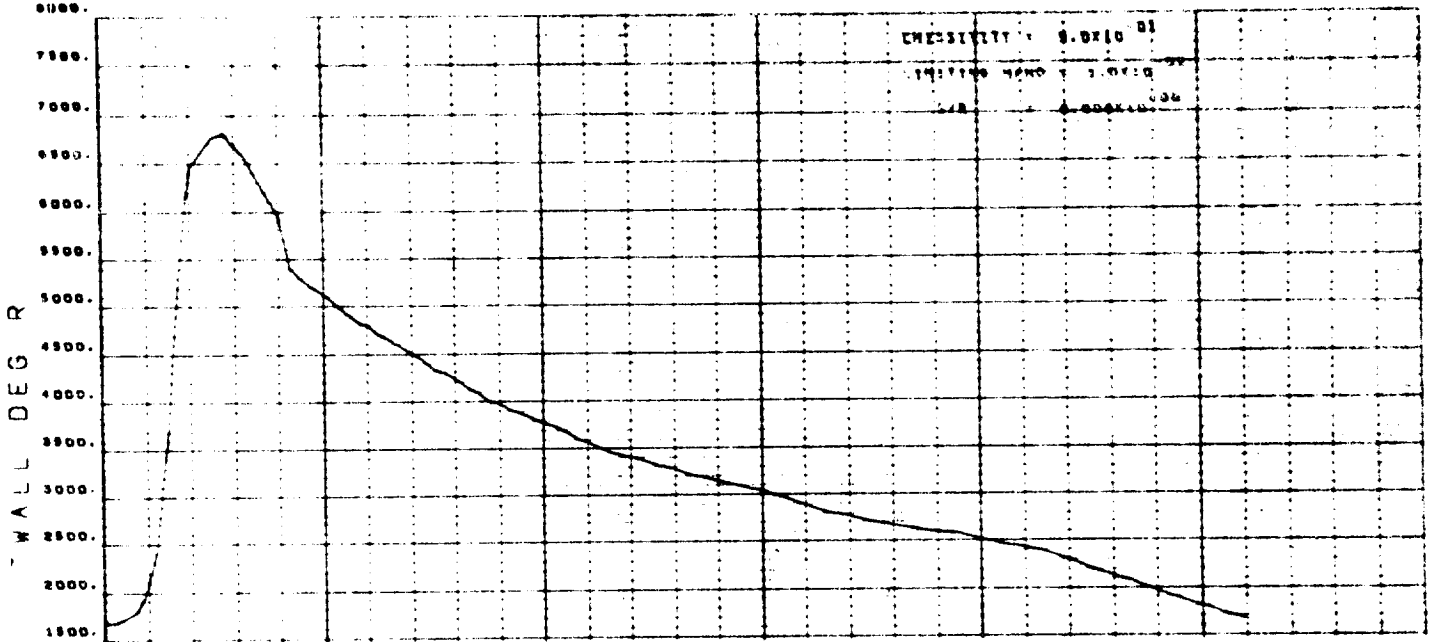


FIGURE 84

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=45500 - TRAJECTORY LB-48 AND LB-47

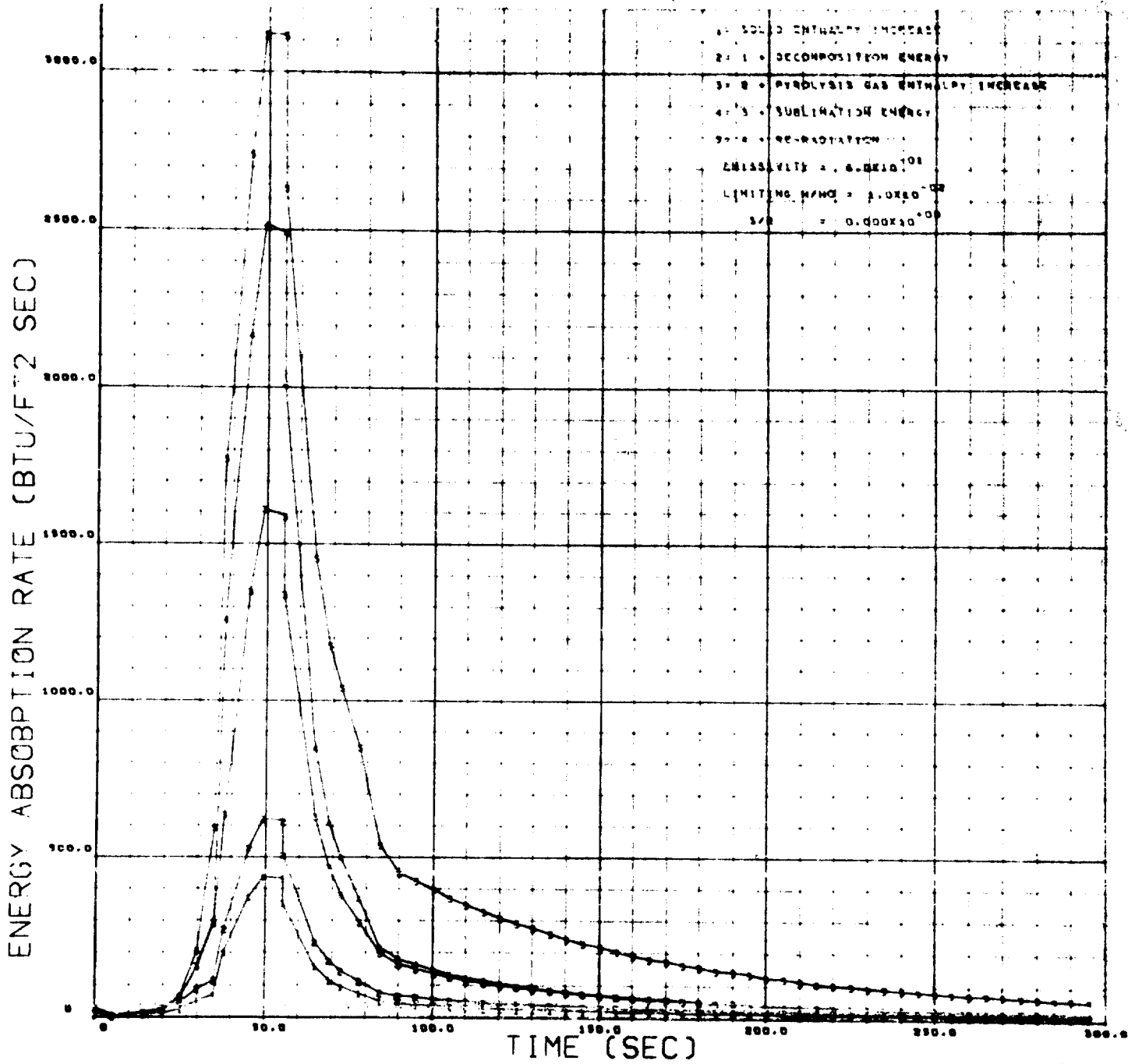


FIGURE 34

MATERIAL RESPONSE DATA

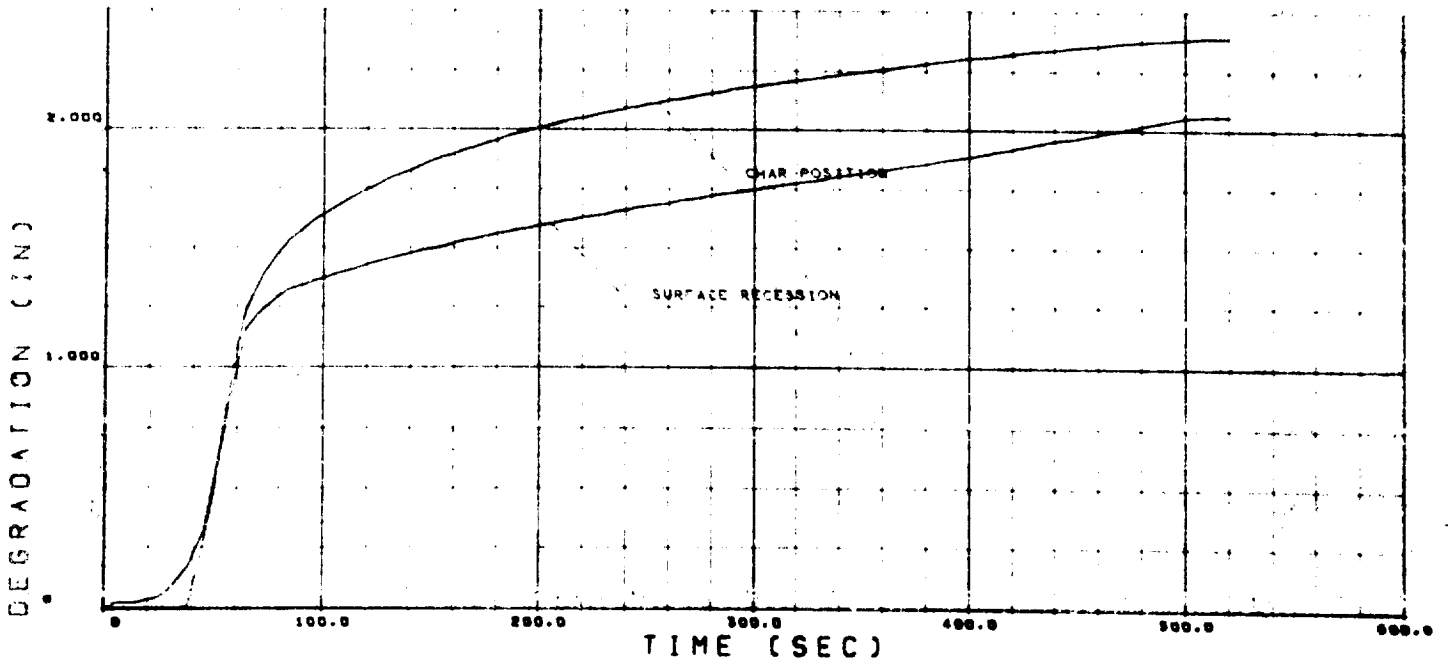
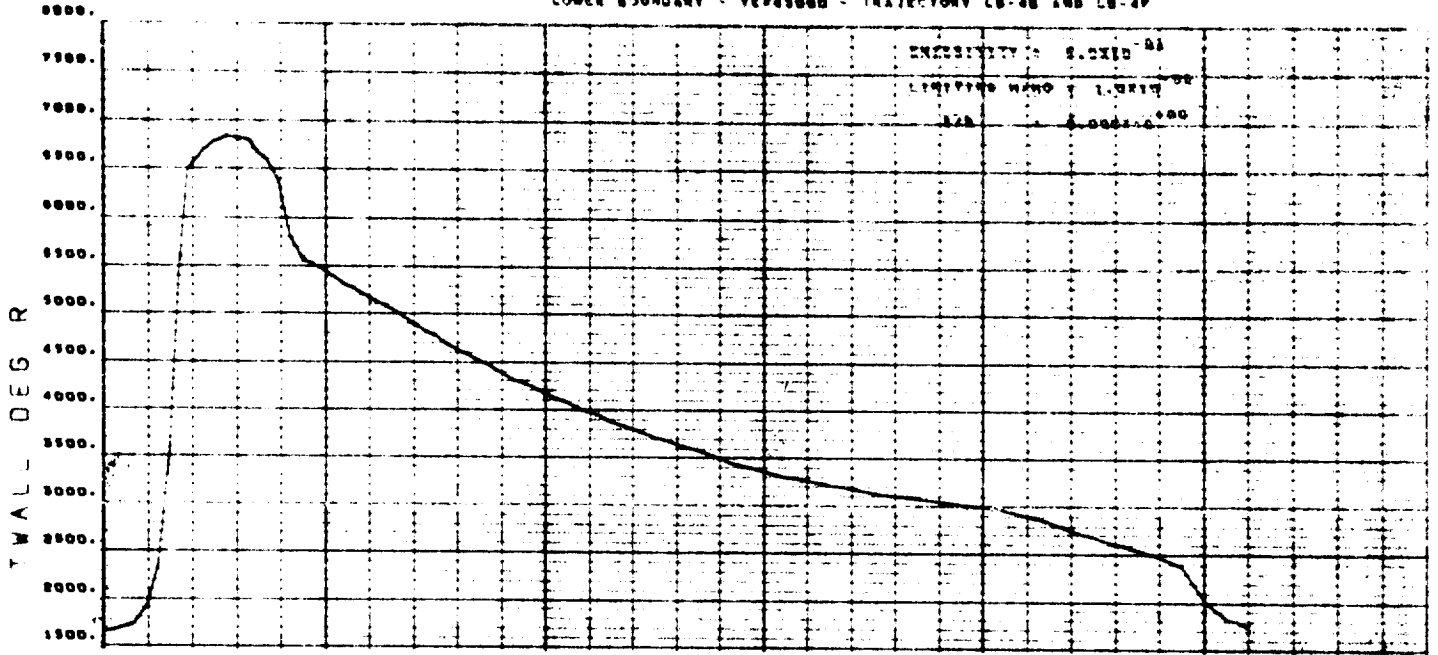


FIGURE 54

HEATING RATE HISTORY

LOWER BOUNDARY - VE=45000 - TRAJECTORY LB-45 AND LB-47

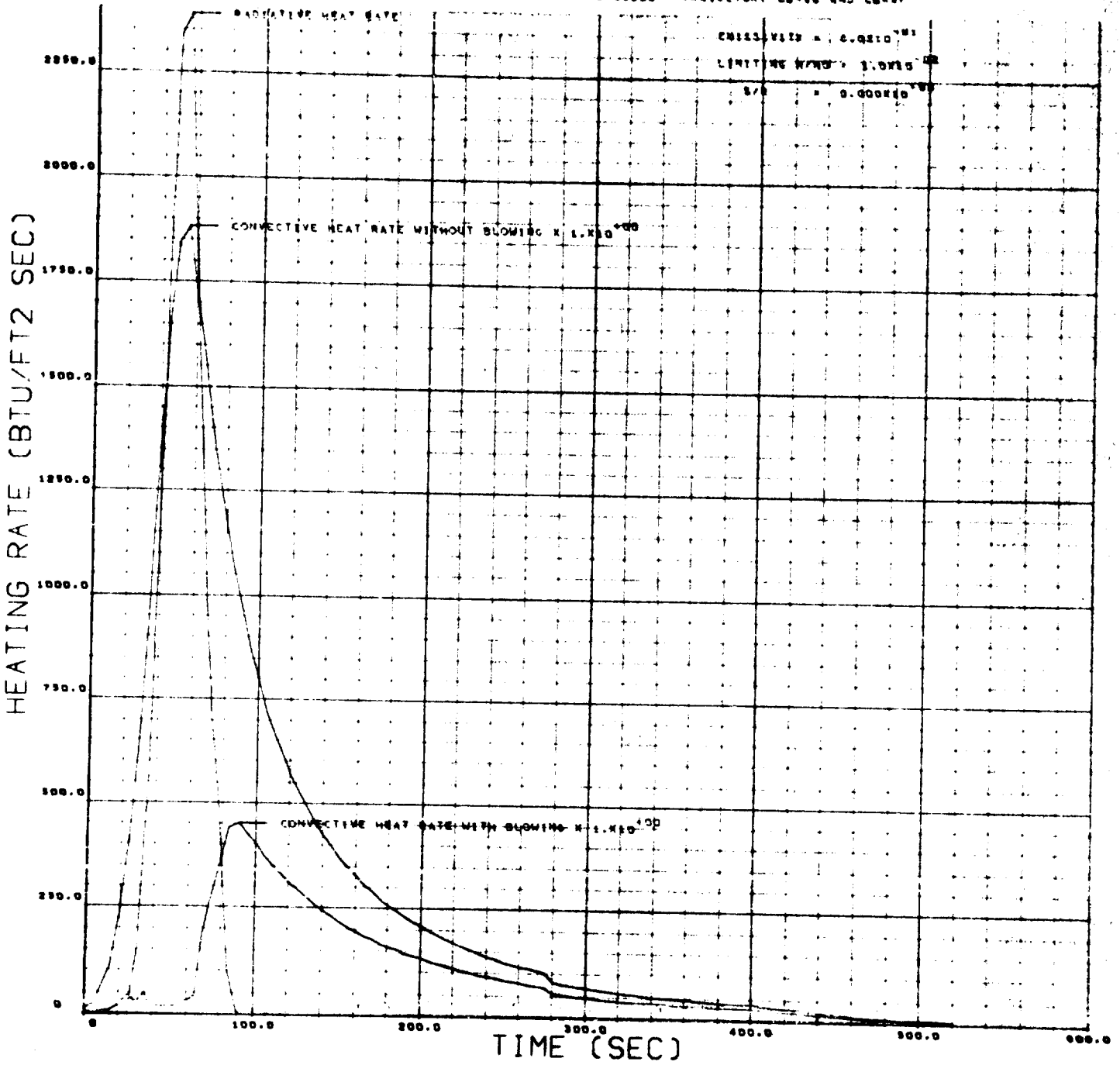


FIGURE B5

HEATING RATE HISTORY

LOWER BOUNDARY - VE:49608 - TRAJECTORY LB-18 AND LB-27

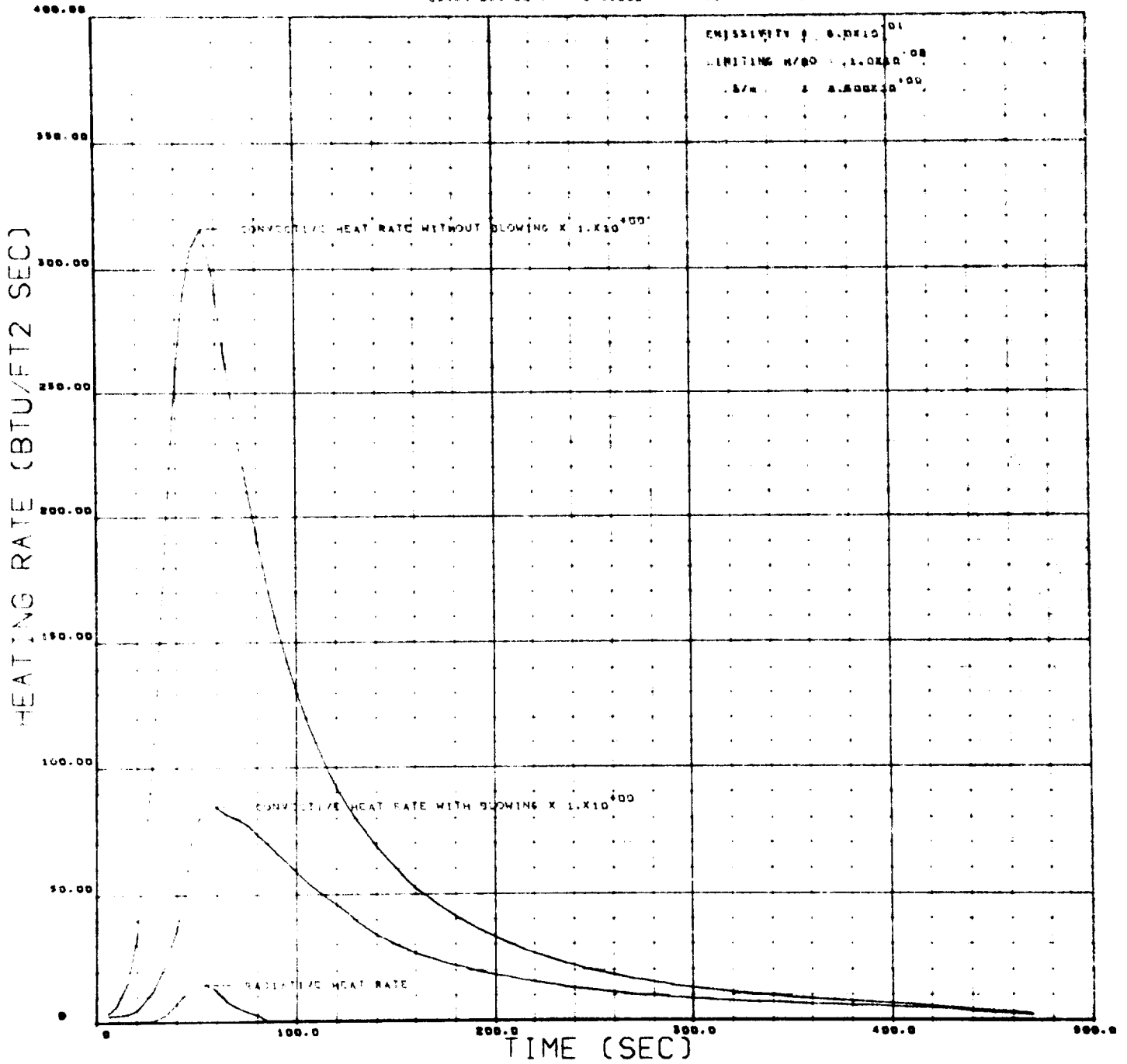


FIGURE B5

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VE=45000 - TRAJECTORY LB-45 AND LB-47

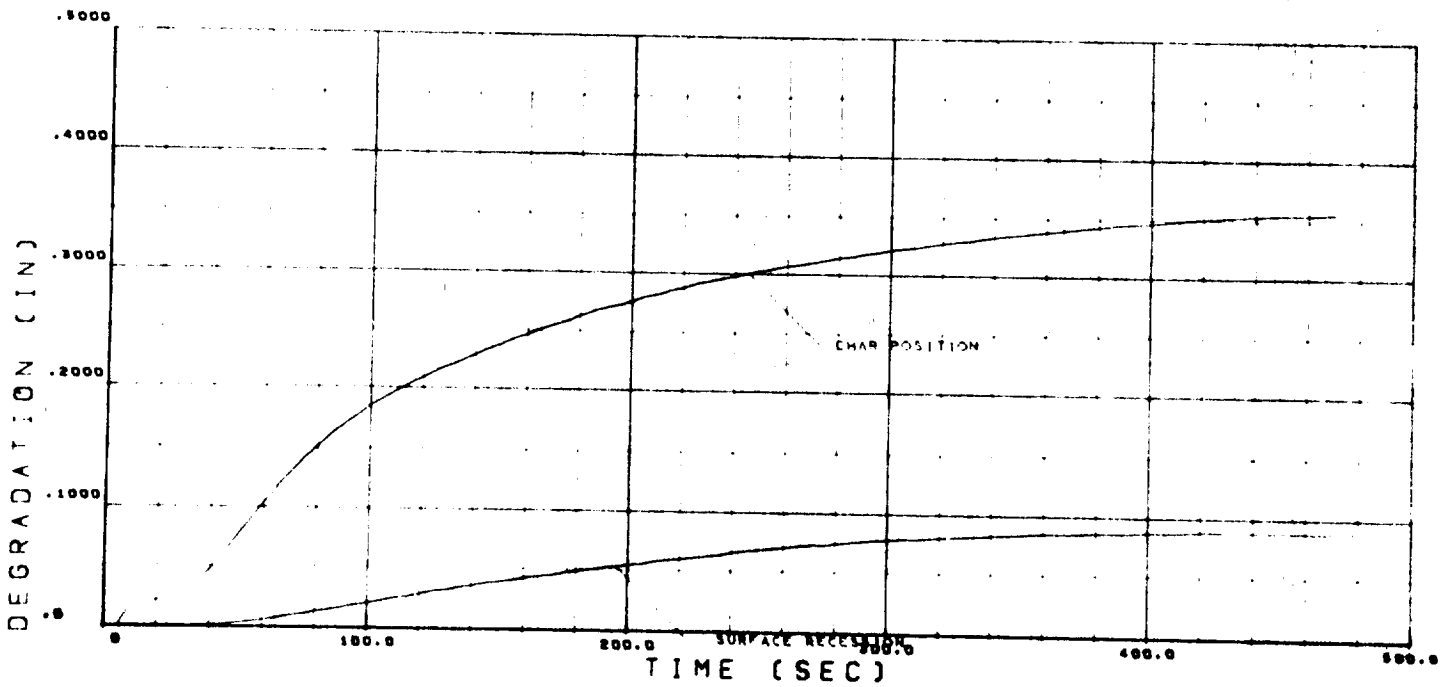
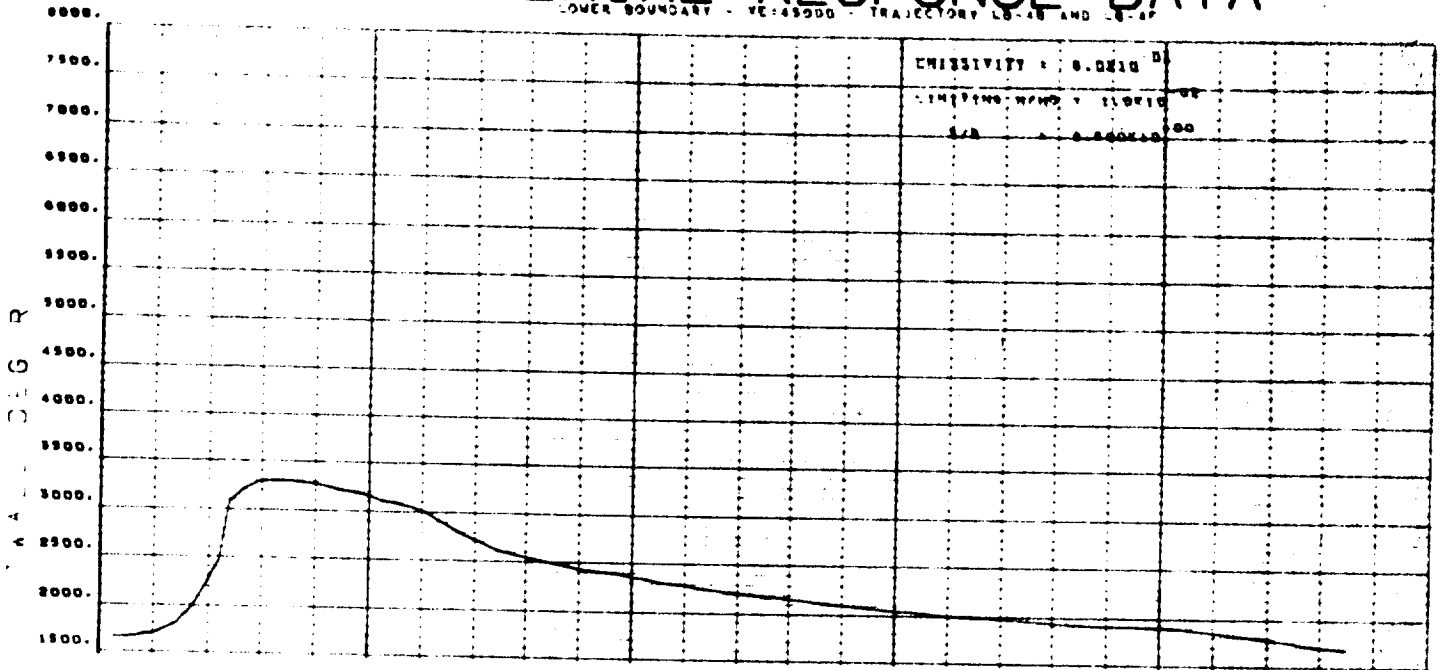


FIGURE B5

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=45000 - TRAJECTORY C6-45 AND C6-47

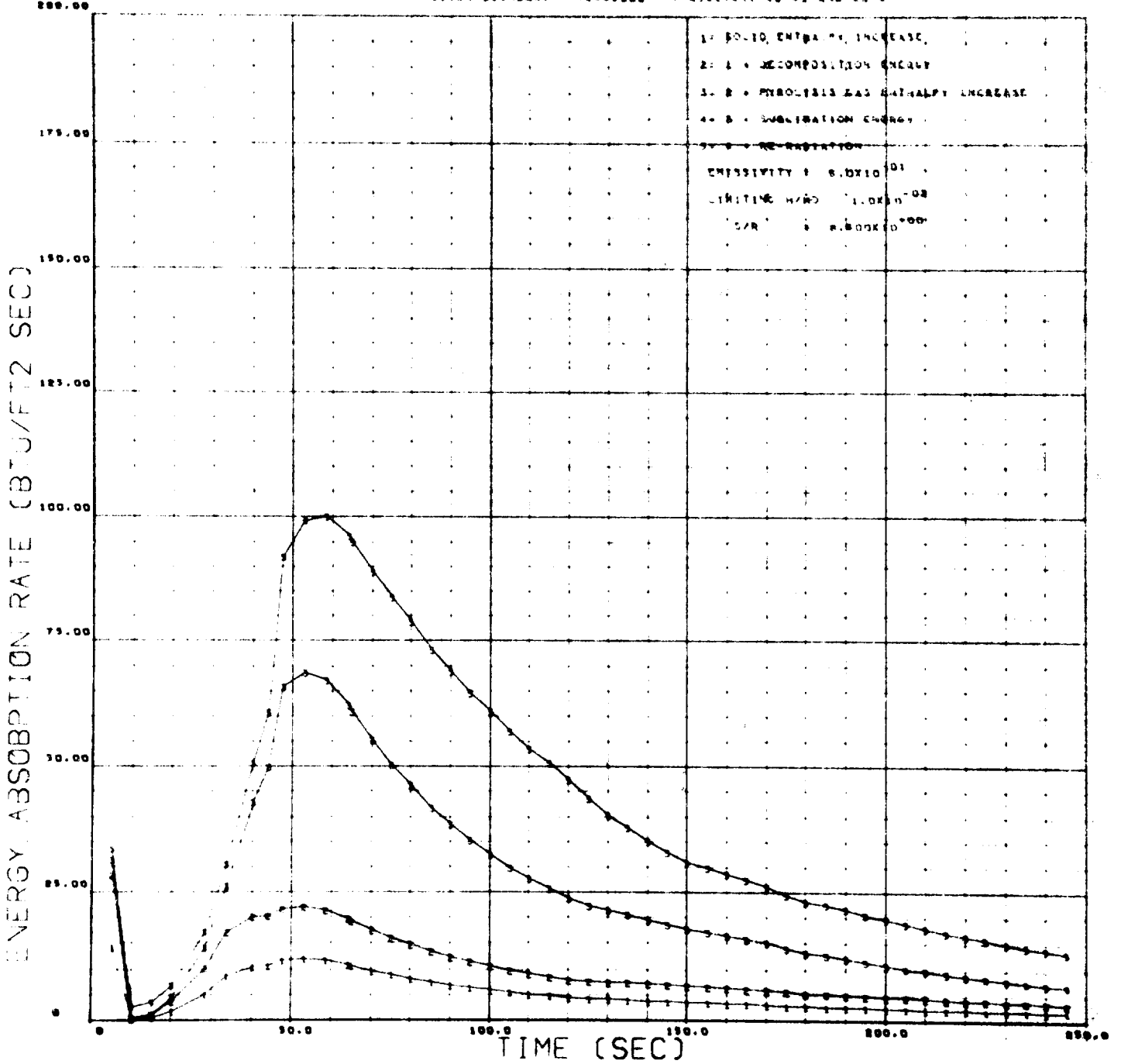


FIGURE 86

HEATING RATE HISTORY

LOWER BOUNDARY - VE=45000 - TRAJECTORY LB-40 AND LB-47

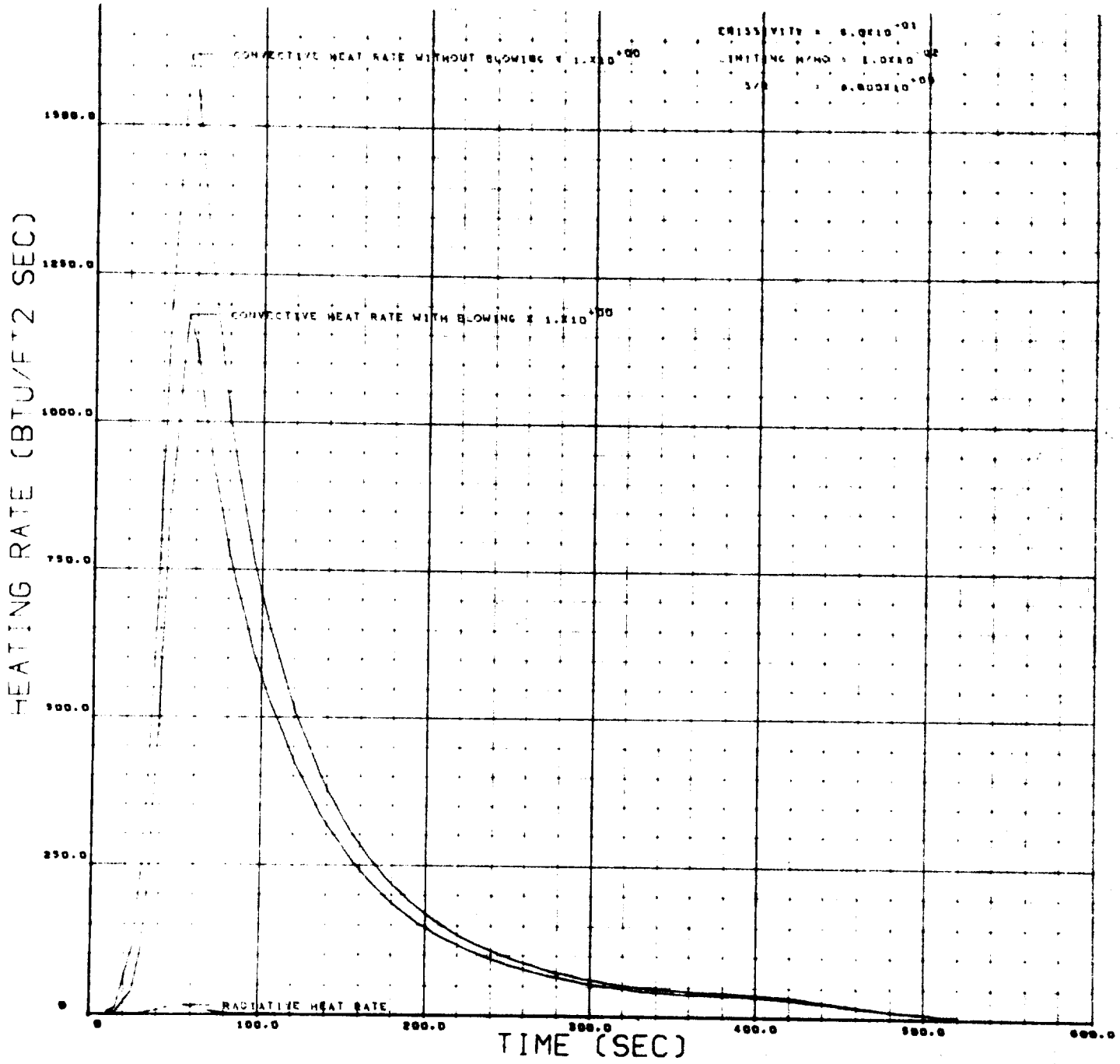


FIGURE B6

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VE=45000 - TRAJECTORY LB-45 AND LB-47

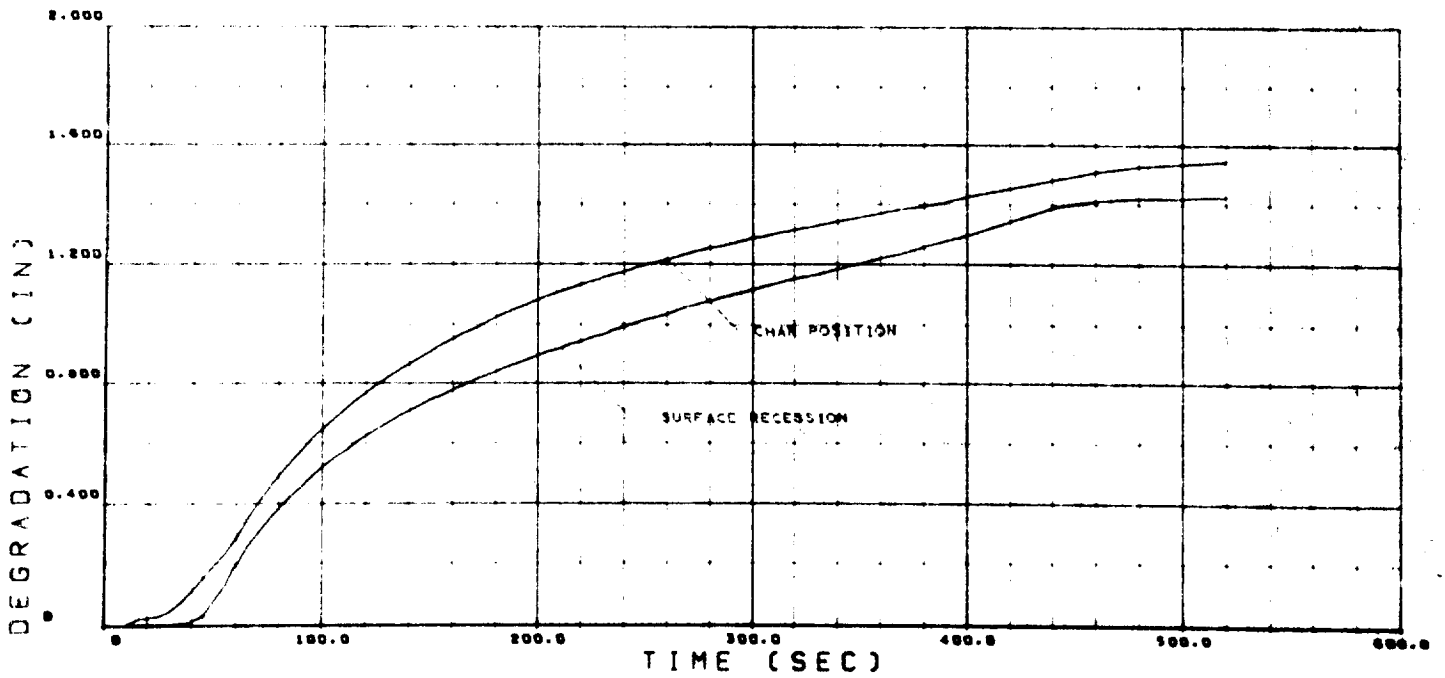
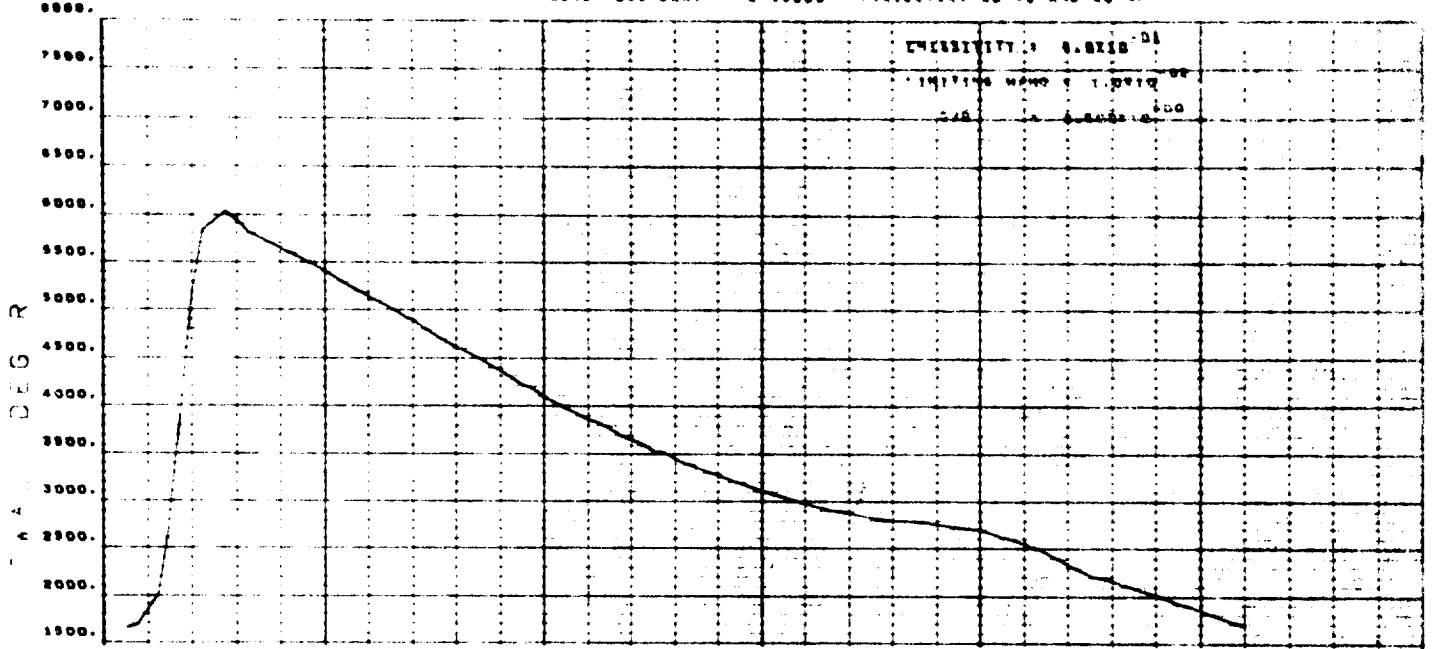


FIGURE B6

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=45000 - TRAJECTORY LB-46 AND LB-47

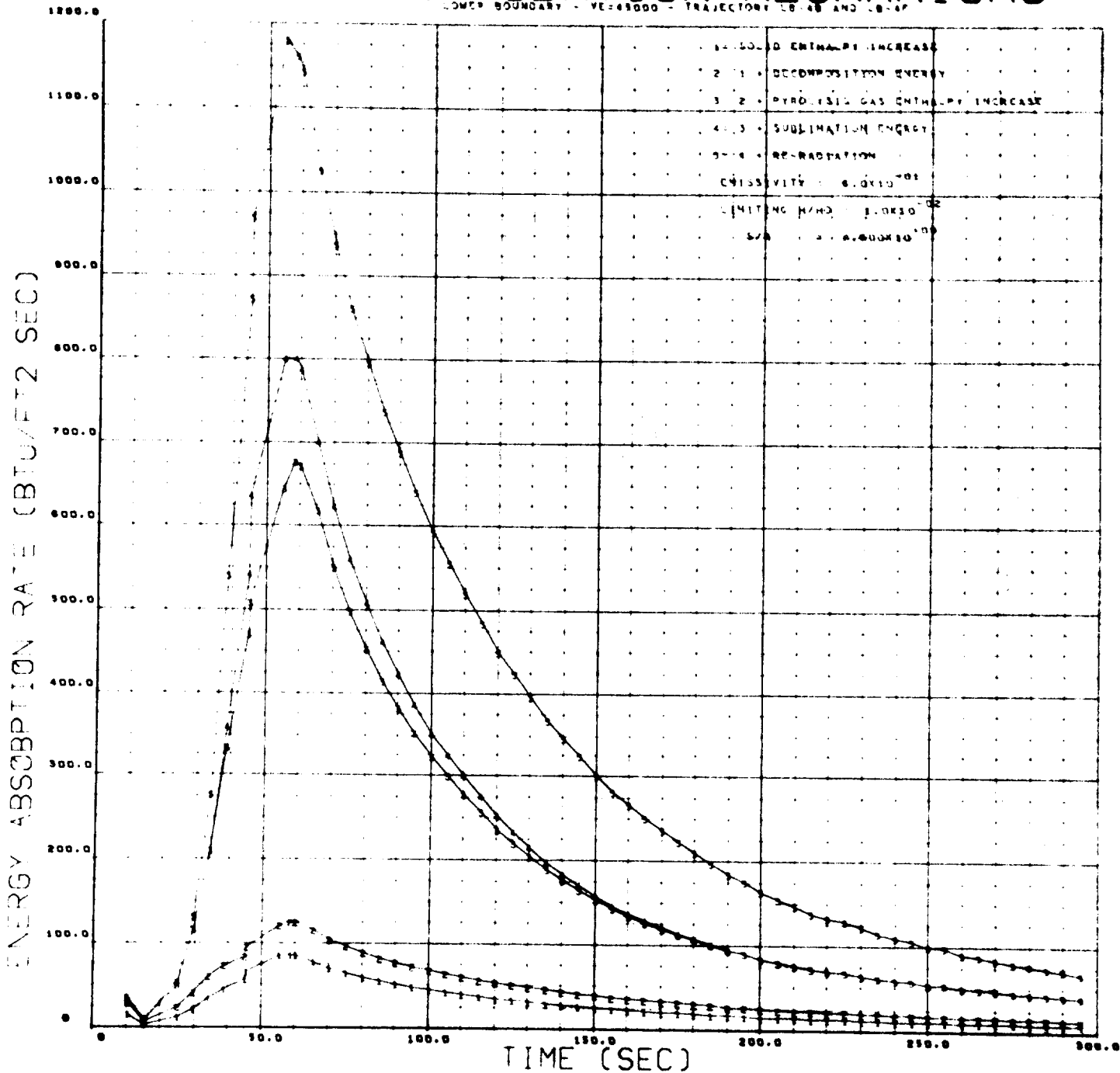


FIGURE B7

HEATING RATE HISTORY

LOWER BOUNDARY - VE=45000 - TRAJECTORY 5-45 AND 5-47

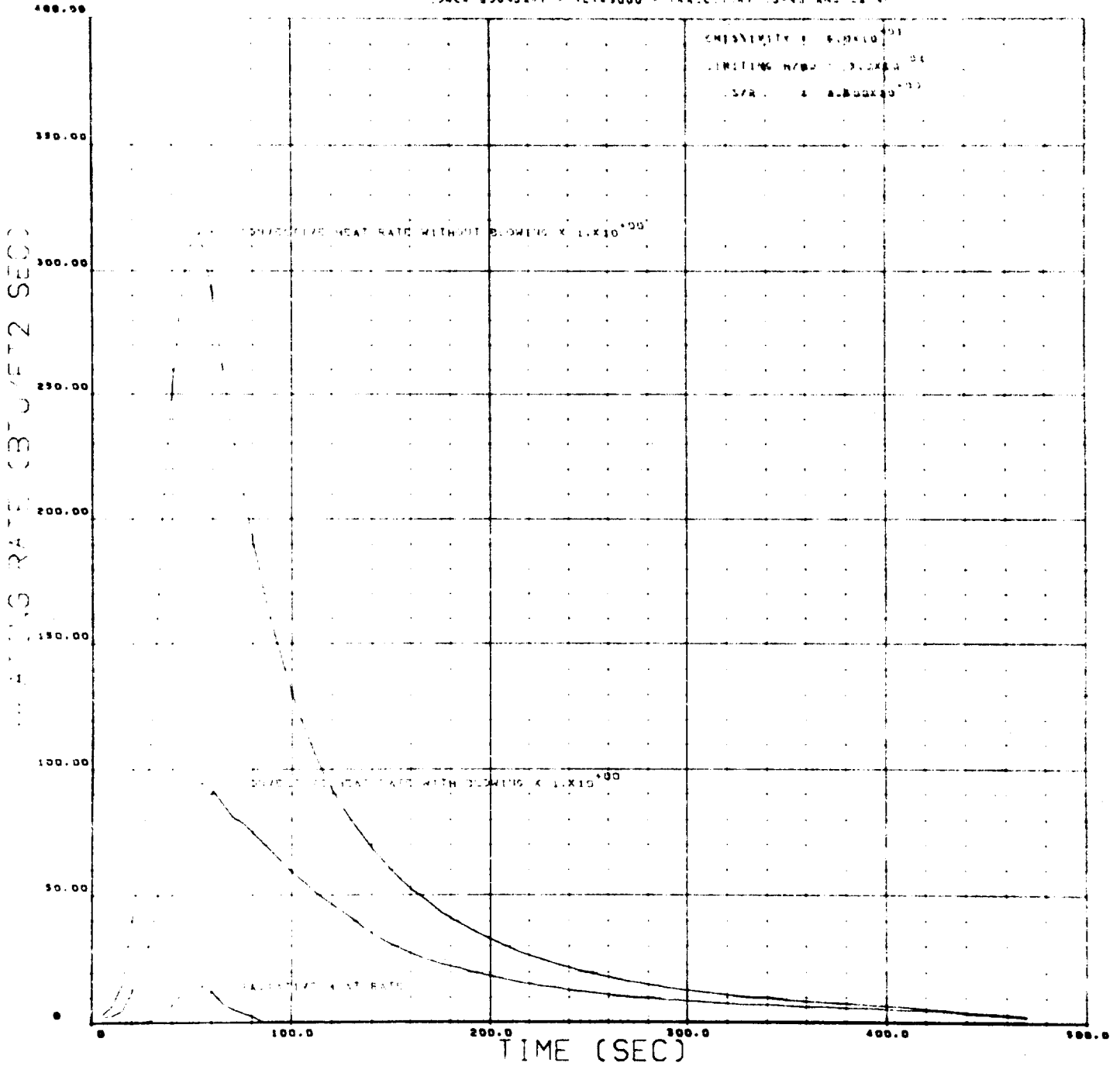


FIGURE B7

MATERIAL RESPONSE DATA

INER BOUNDARY - VC-45000 - TRAJECTORY LB-45 AND LB-47

EMISSIVITY : 0.0810 01
LIMITING TEMPERATURE : 3000 01
SIZE : 0.00010 00

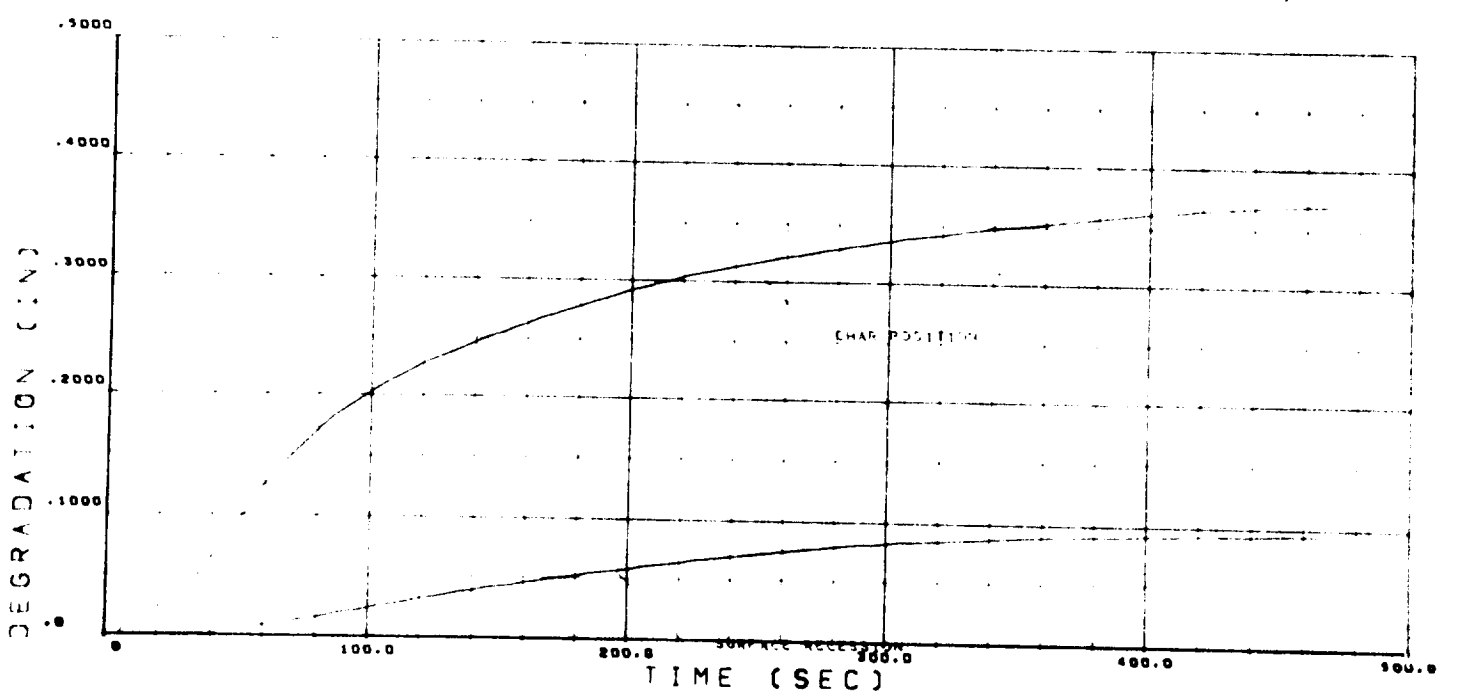
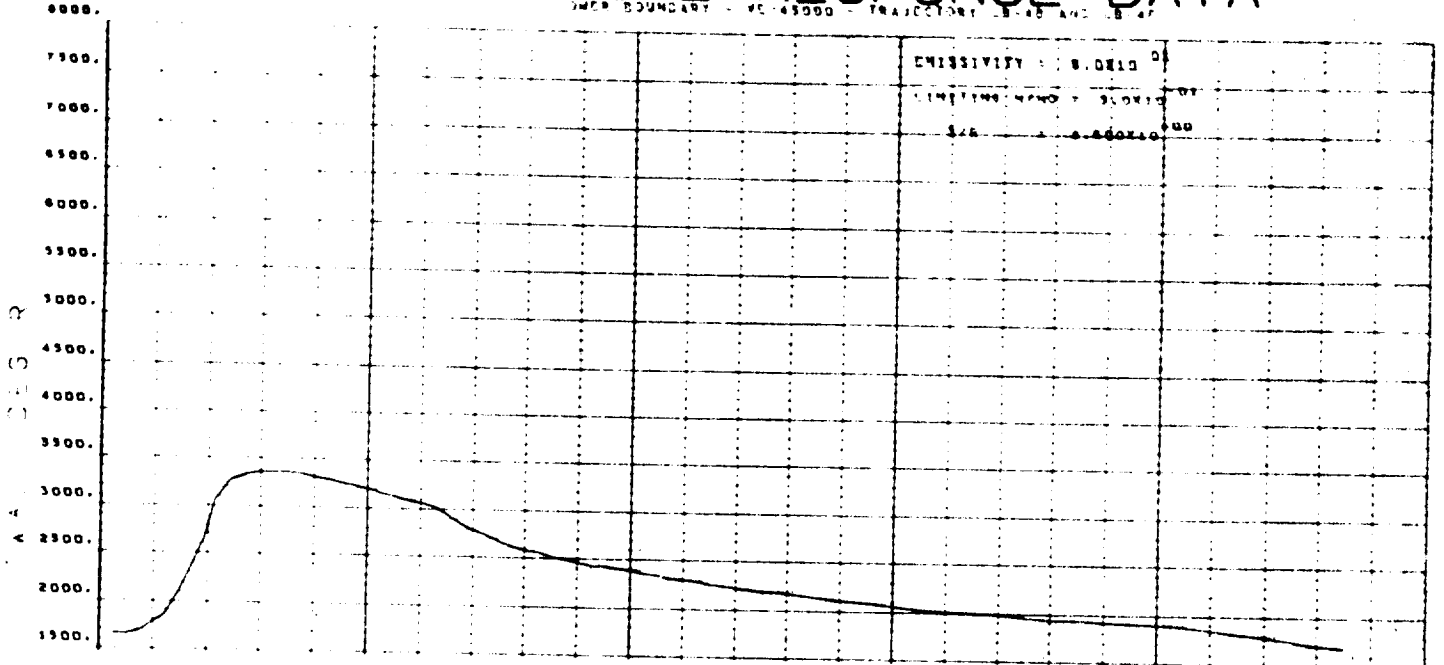


FIGURE B7

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - 40 45000 TRAIL 1000 LB 40 4500 LB 40

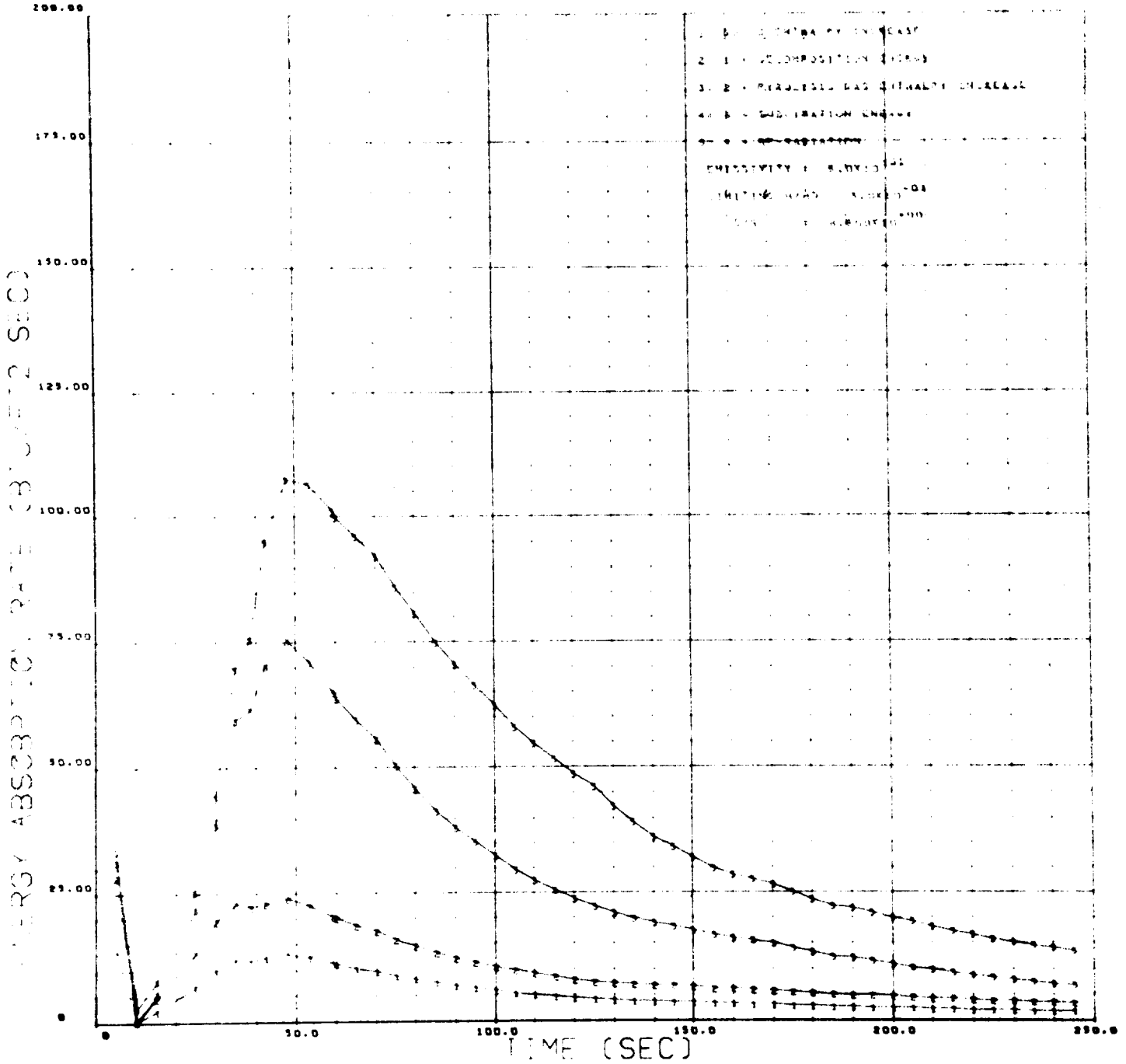


FIGURE B8

HEATING RATE HISTORY

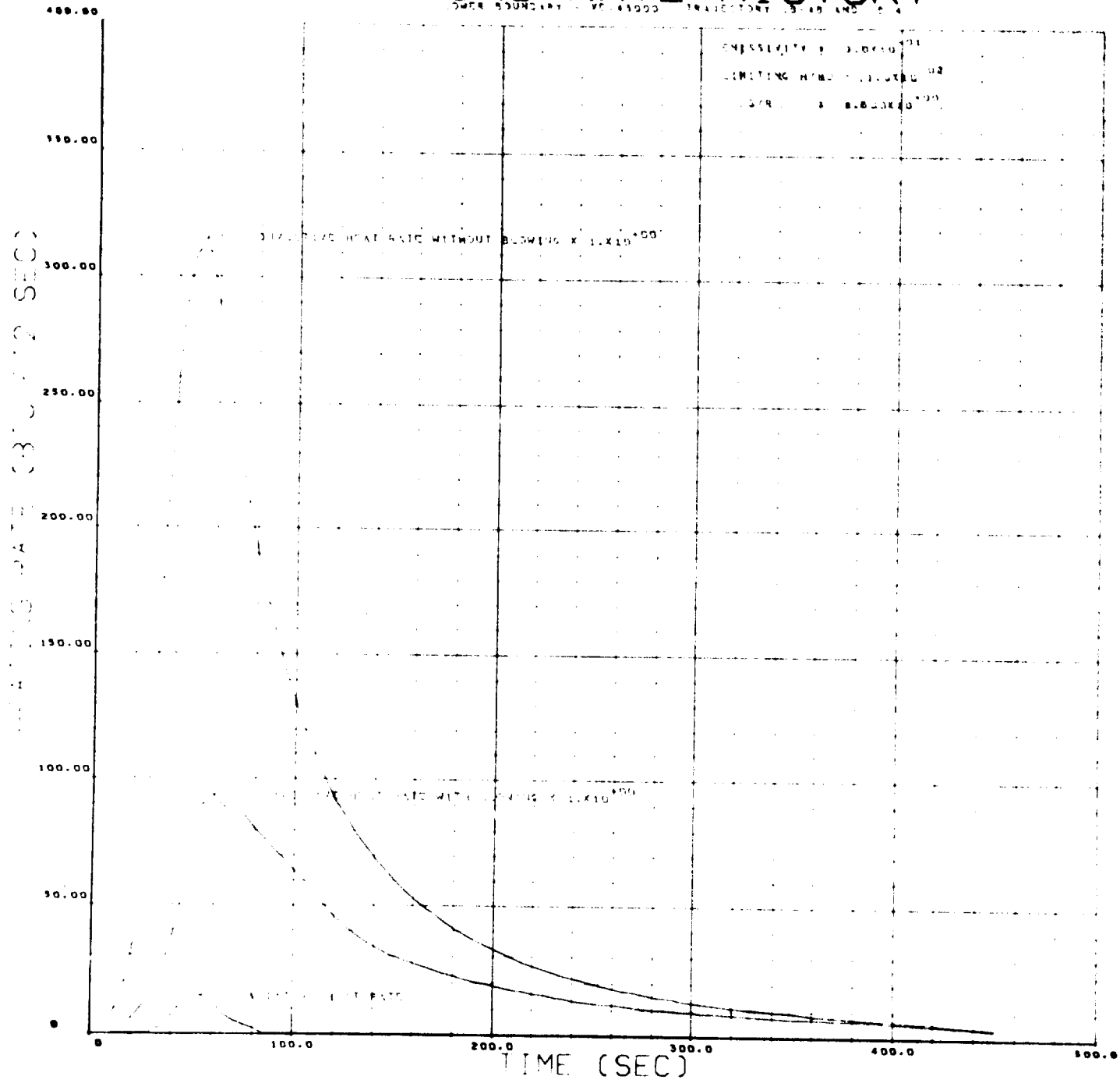


FIGURE B8

MATERIAL RESPONSE DATA

LOWER BOUNDARY VE 48000 TRAJECTORY 16.48 AND 16.47

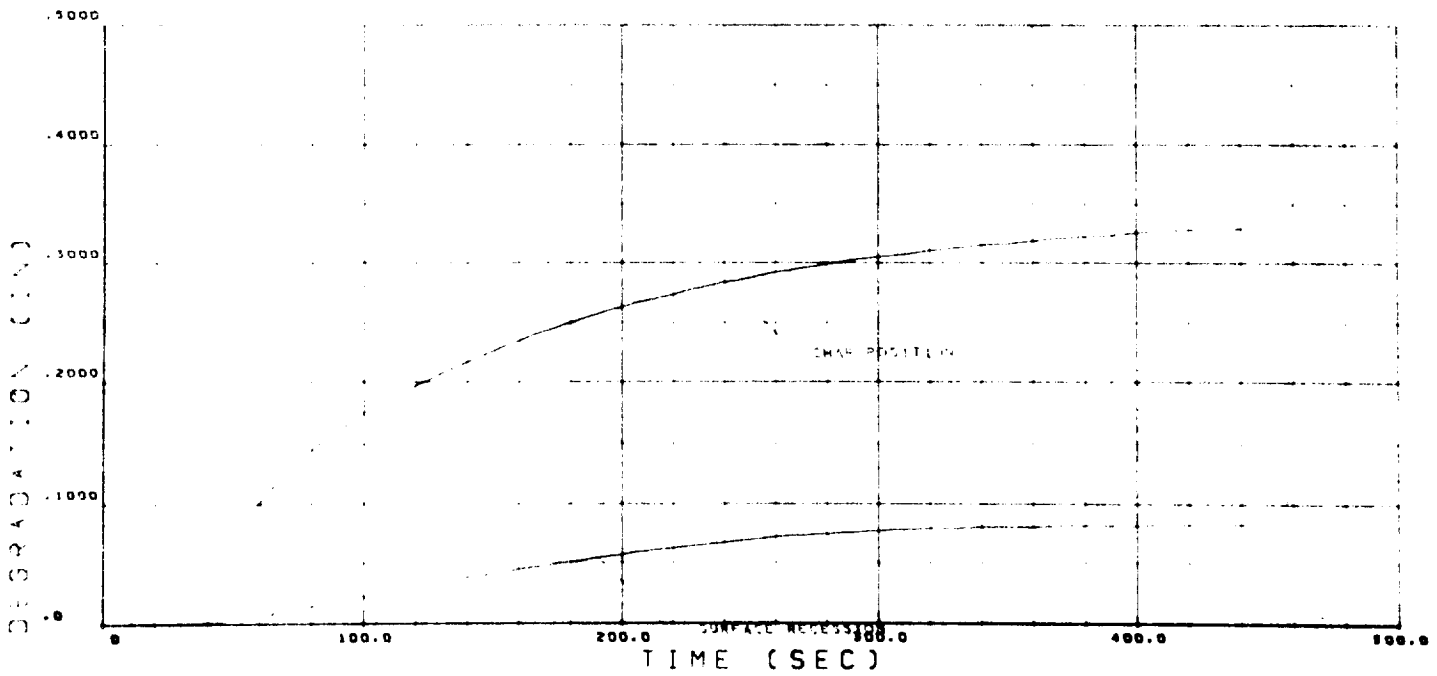
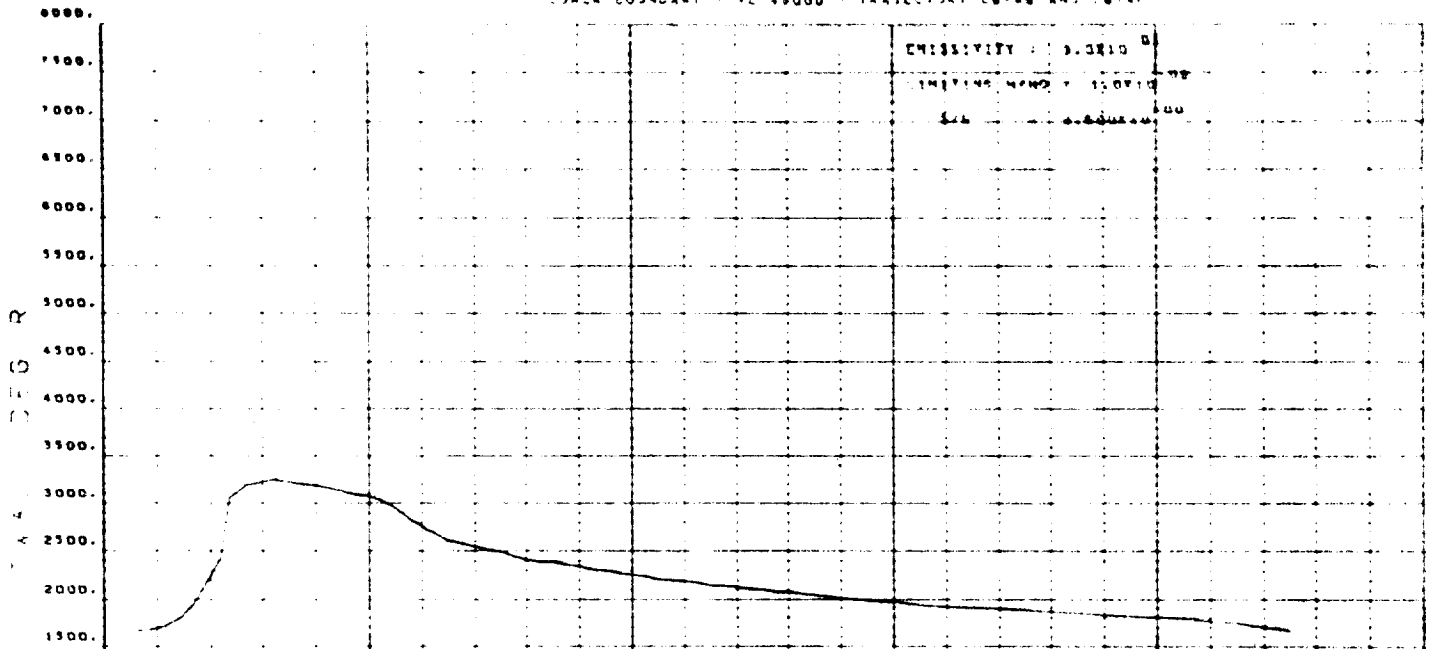


FIGURE B8

ENERGY ACCOMMODATION MECHANISMS

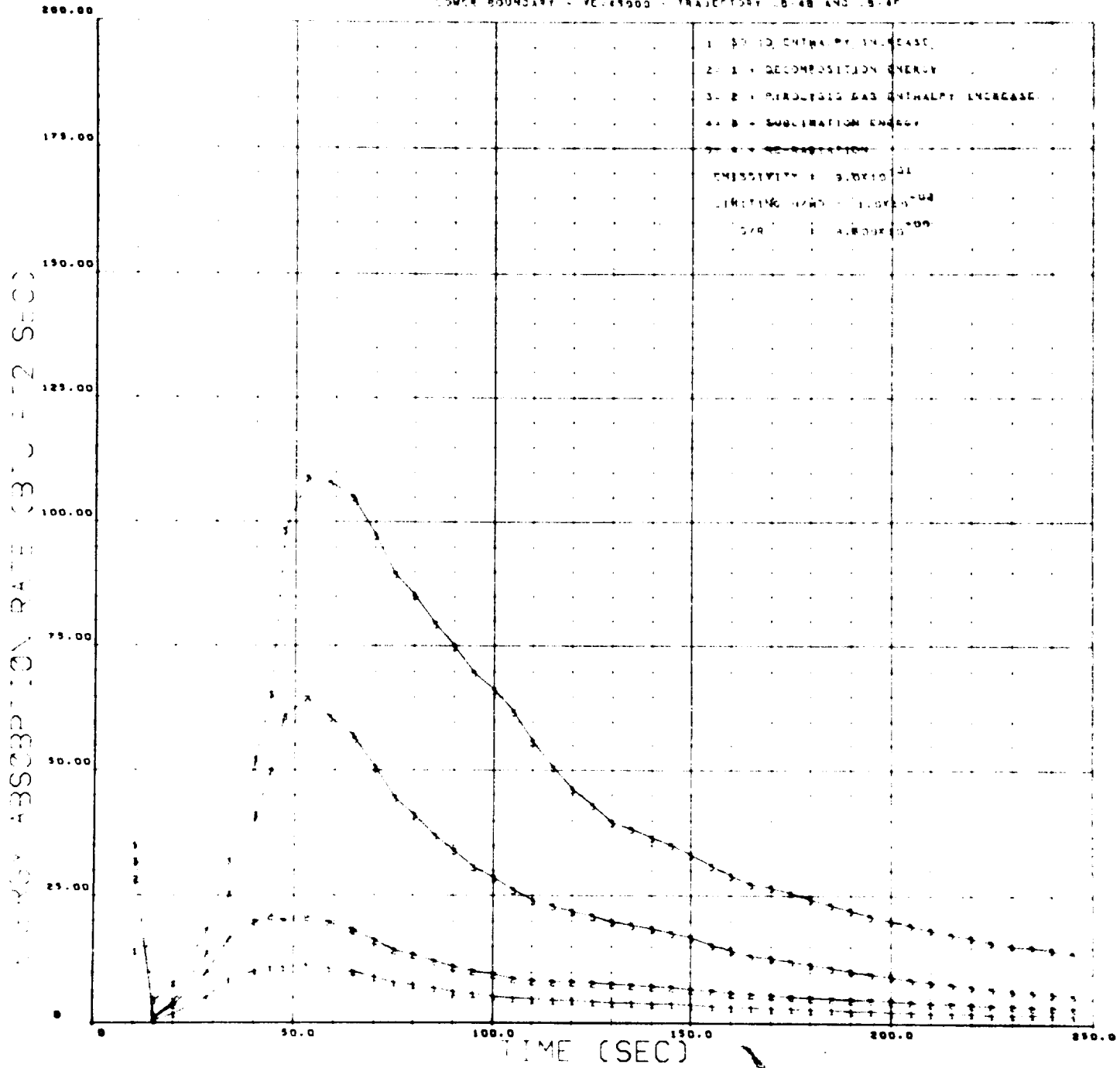


FIGURE B9

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY VE=45000 TRAJECTORY 10-48 AND 10-47

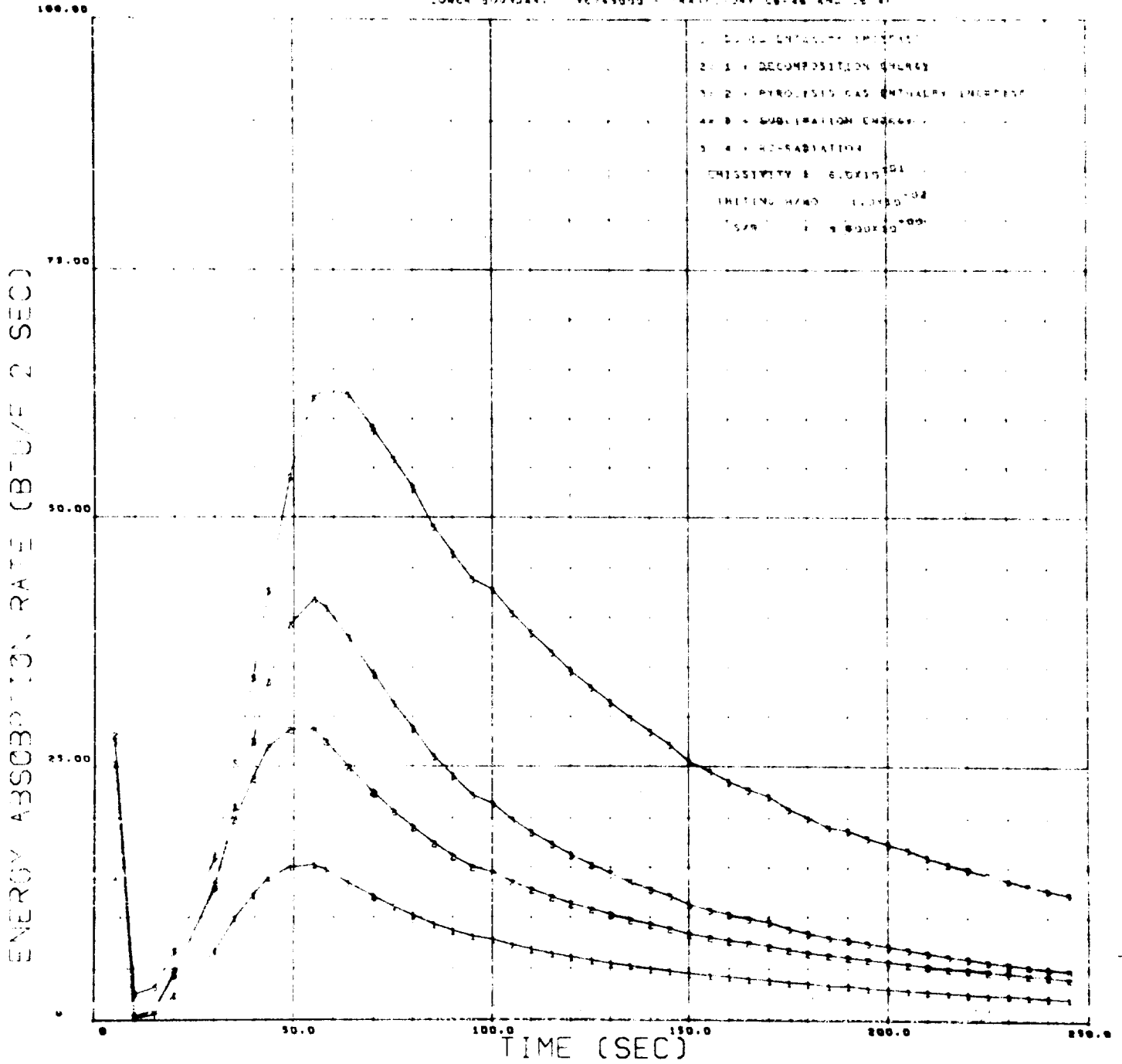


FIGURE B9

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VC 45000 - TRAJECTORY 20-45 AND 25-47

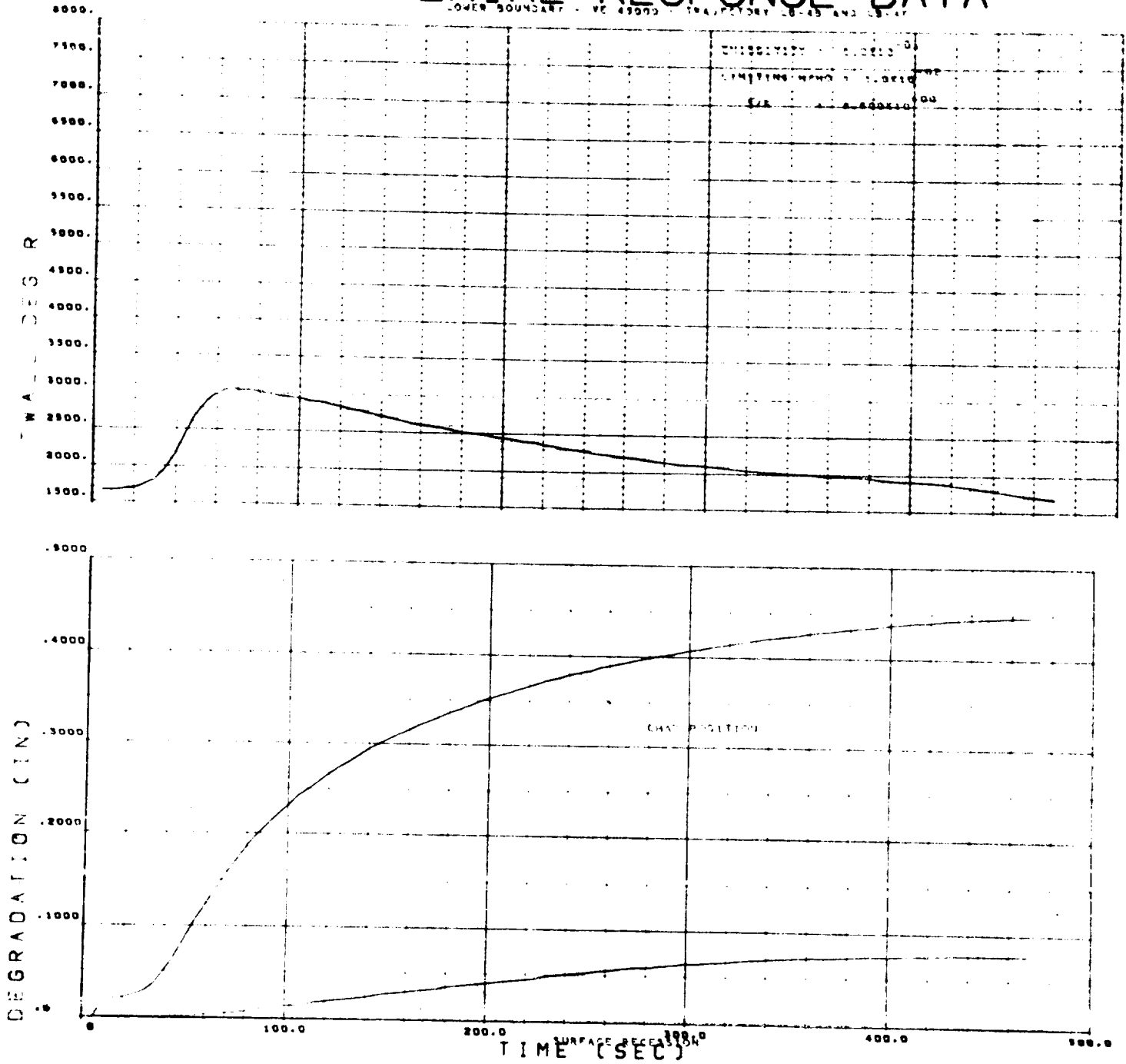
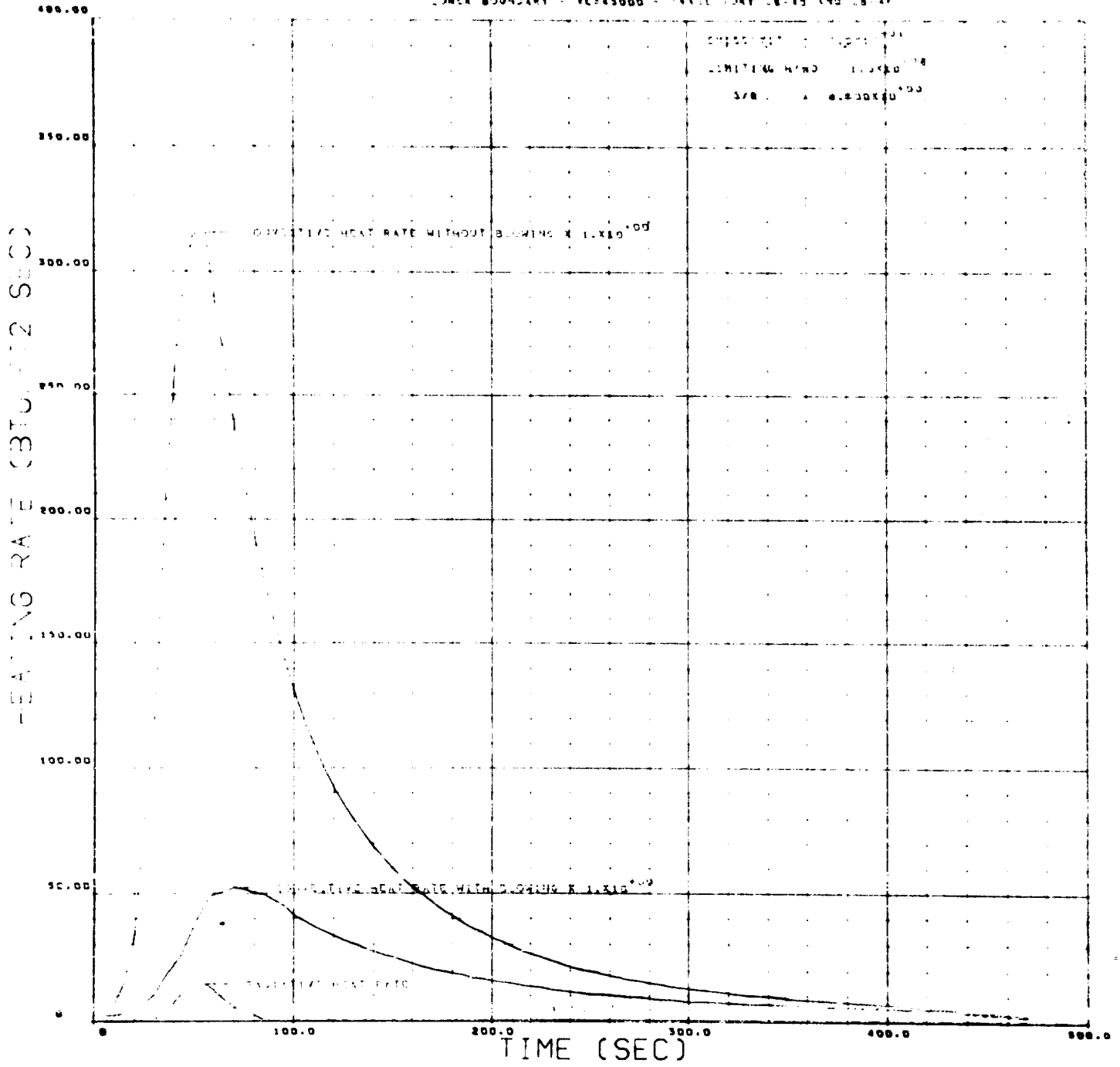


FIGURE B9

HEATING RATE HISTORY



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FIGURE B10

ENERGY ACCOMMODATION MECHANISMS

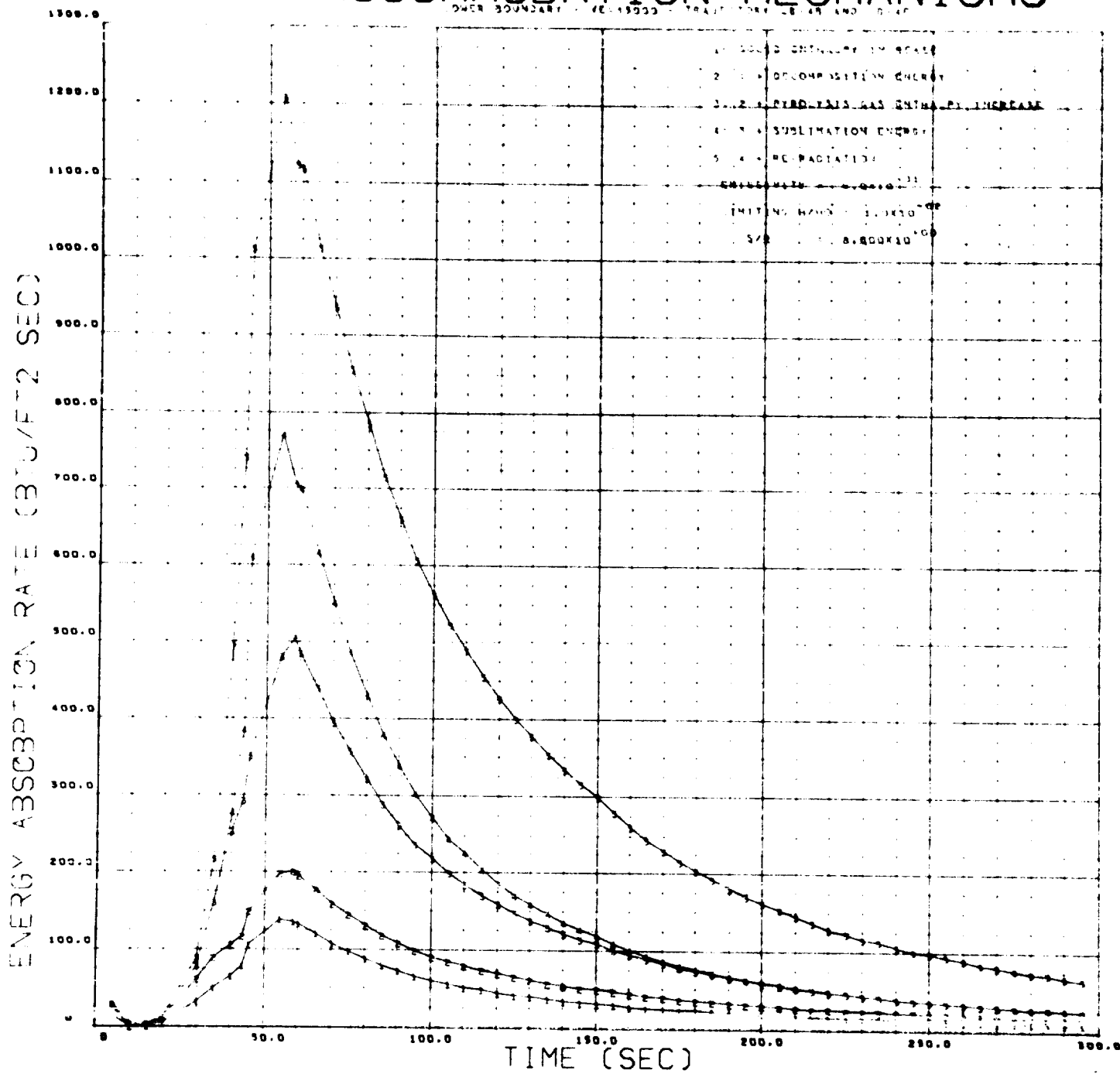


FIGURE B10

MATERIAL RESPONSE DATA

LOWER BOUNDARY VE 45000 TRAJECTORY 10-25 AND 10-27

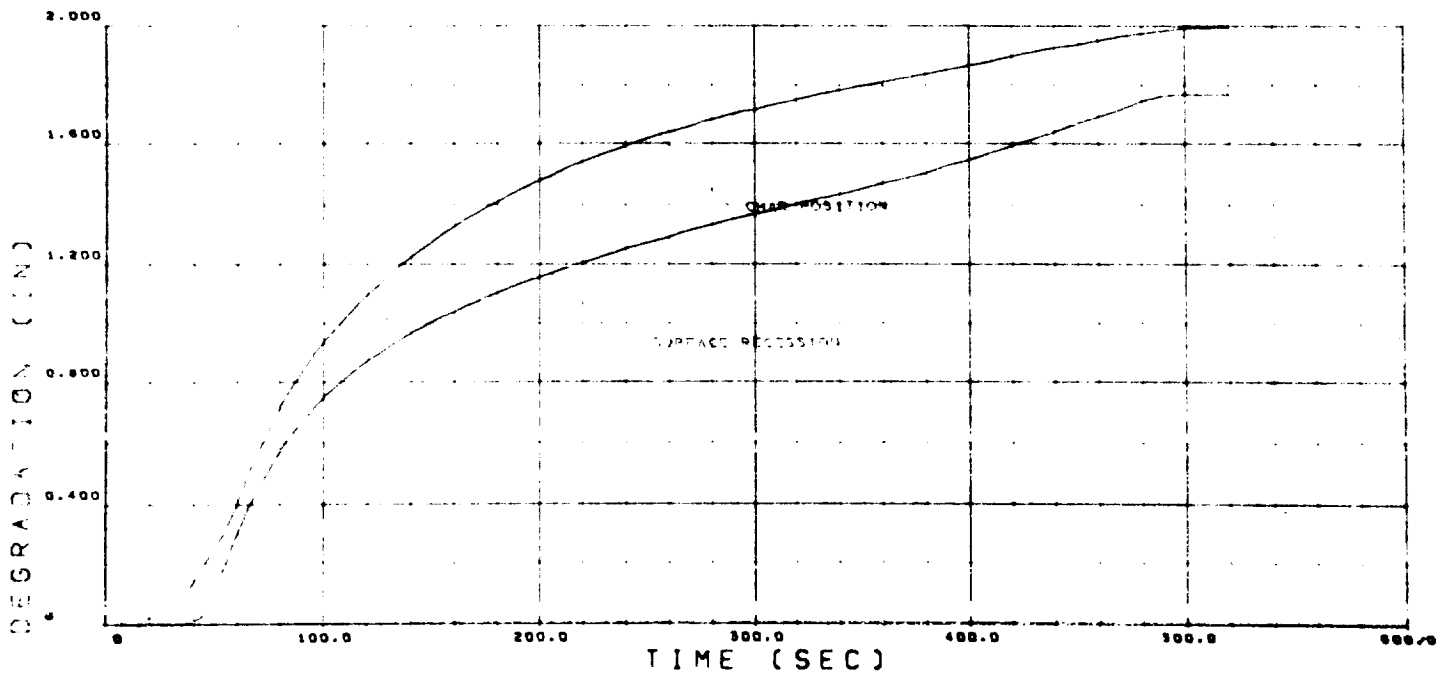
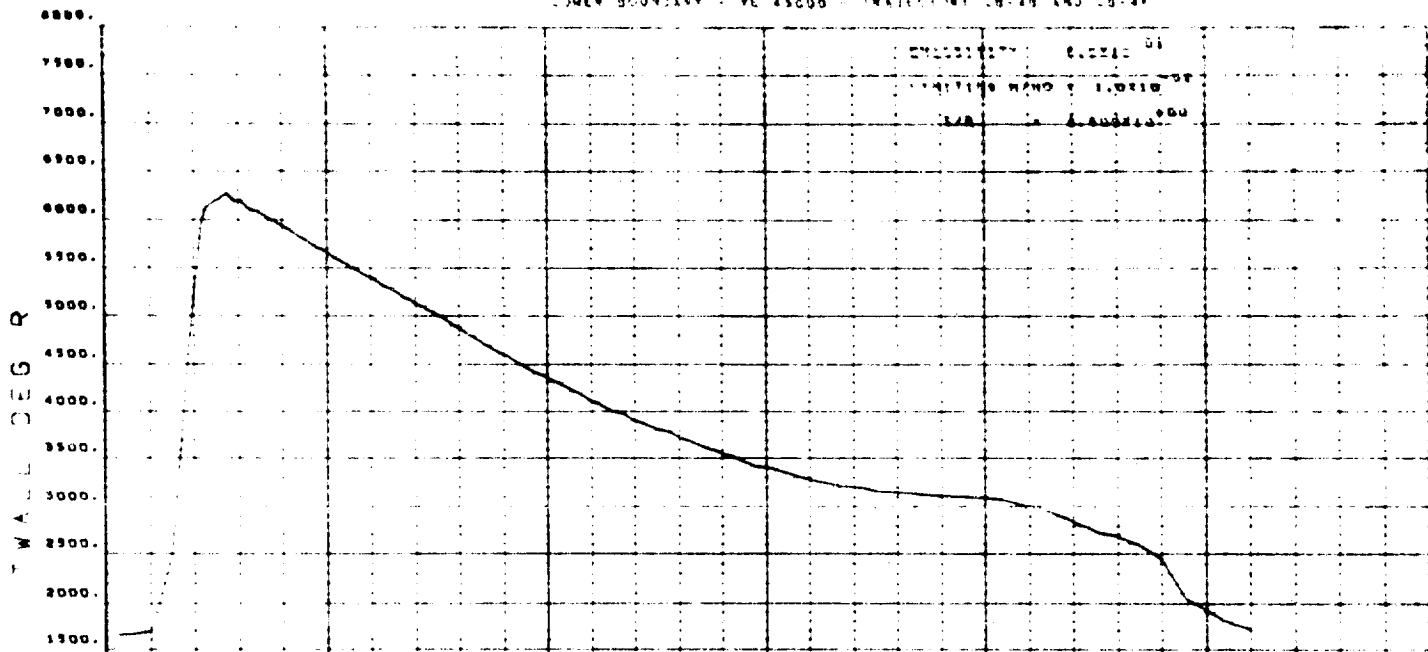


FIGURE B11

HEATING RATE HISTORY

LOWER BOUNDARY - VE=30000 - TRAJECTORY .8-92 AND .8-97

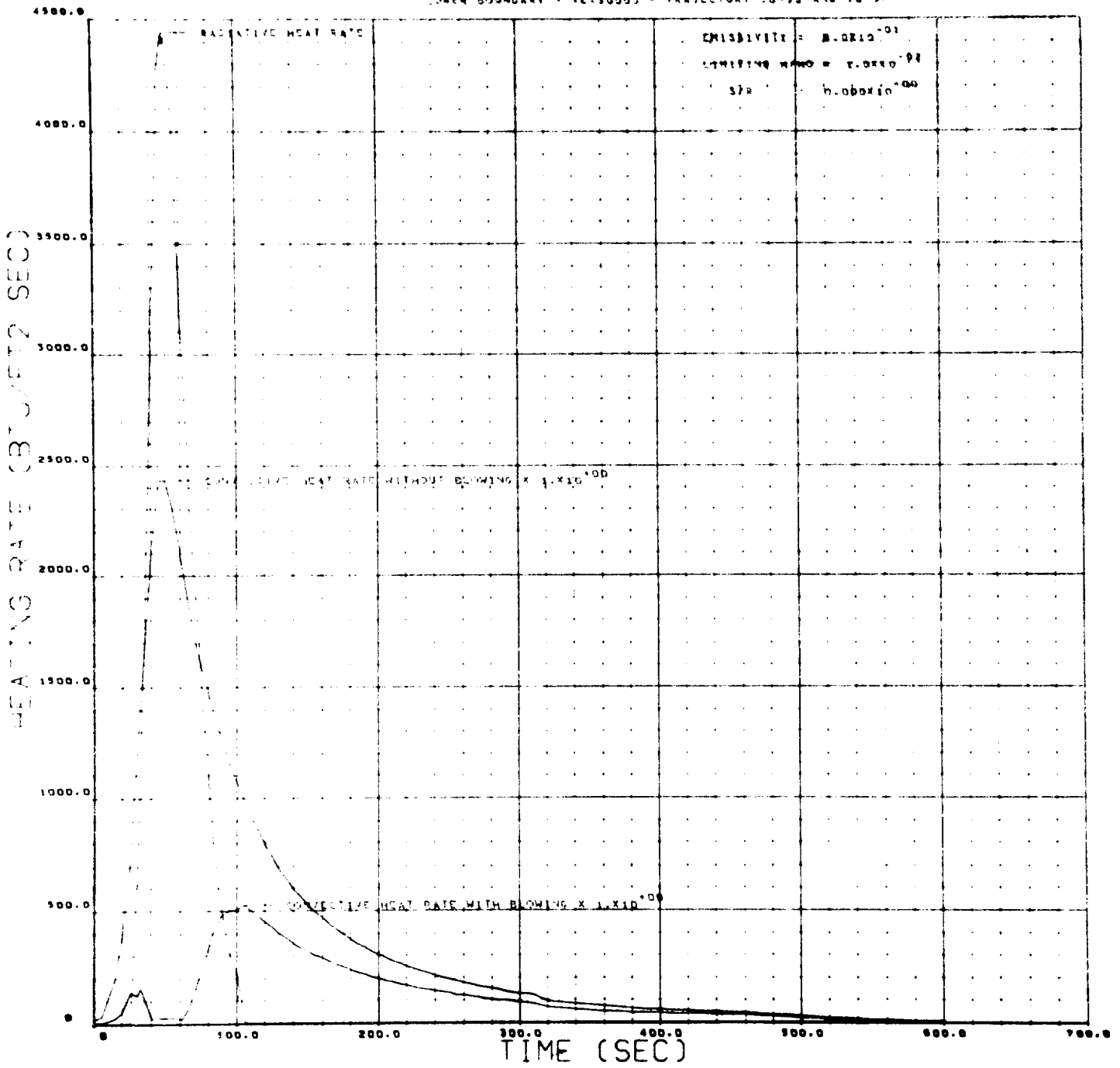


FIGURE B11

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VE=50000 - TRAJECTORY 18-18 AND 18-17

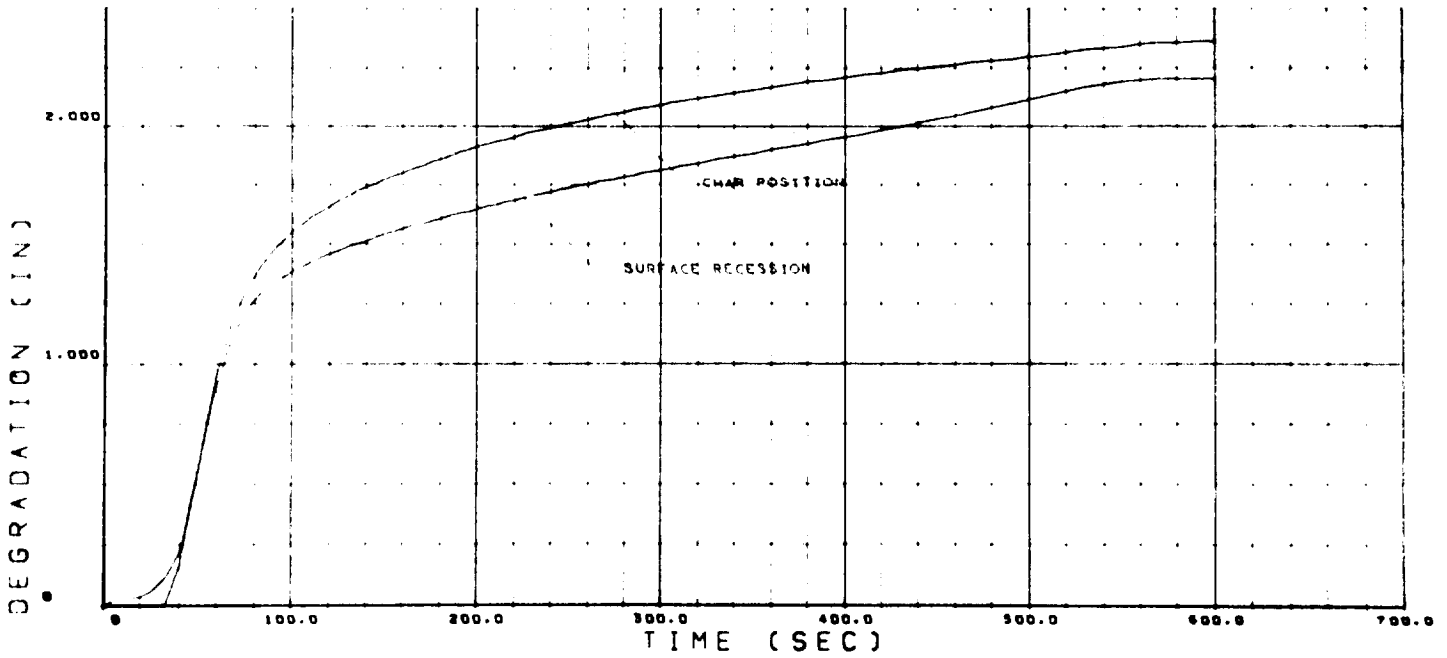
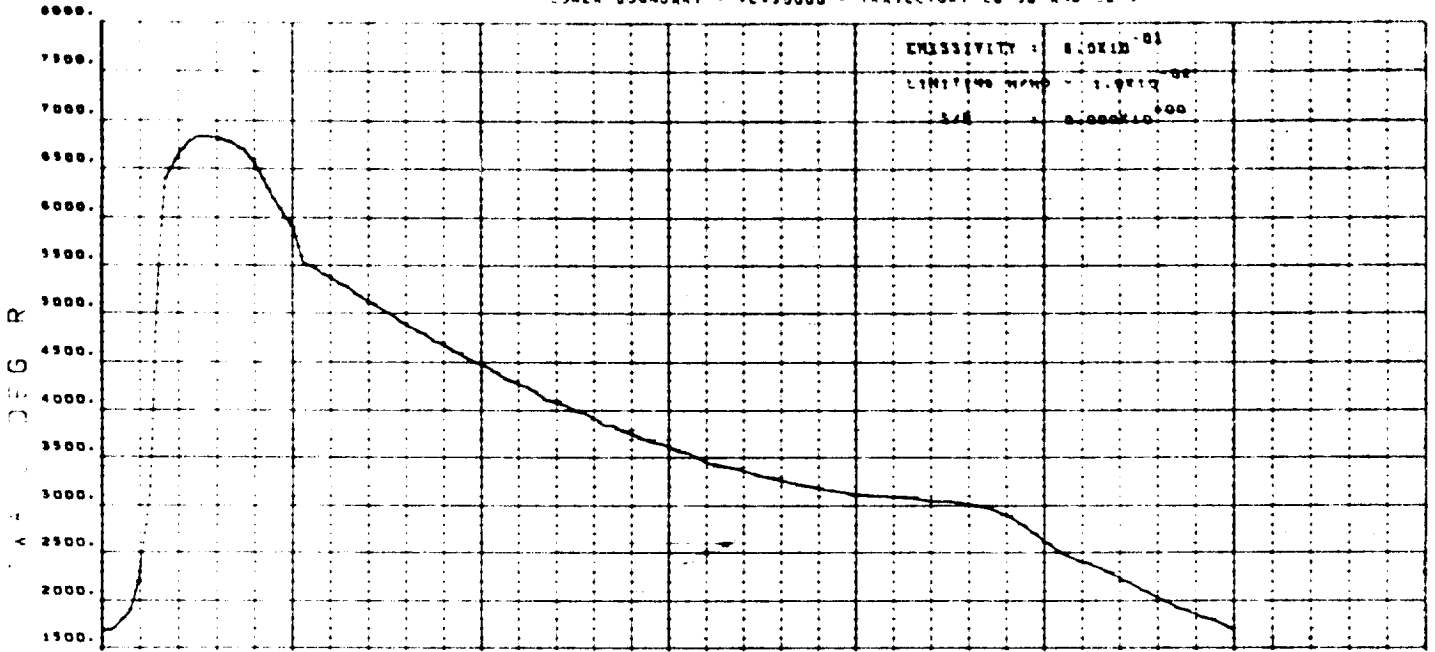


FIGURE B11

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=50000 - TRAJECTORY LB-58 AND LB-57

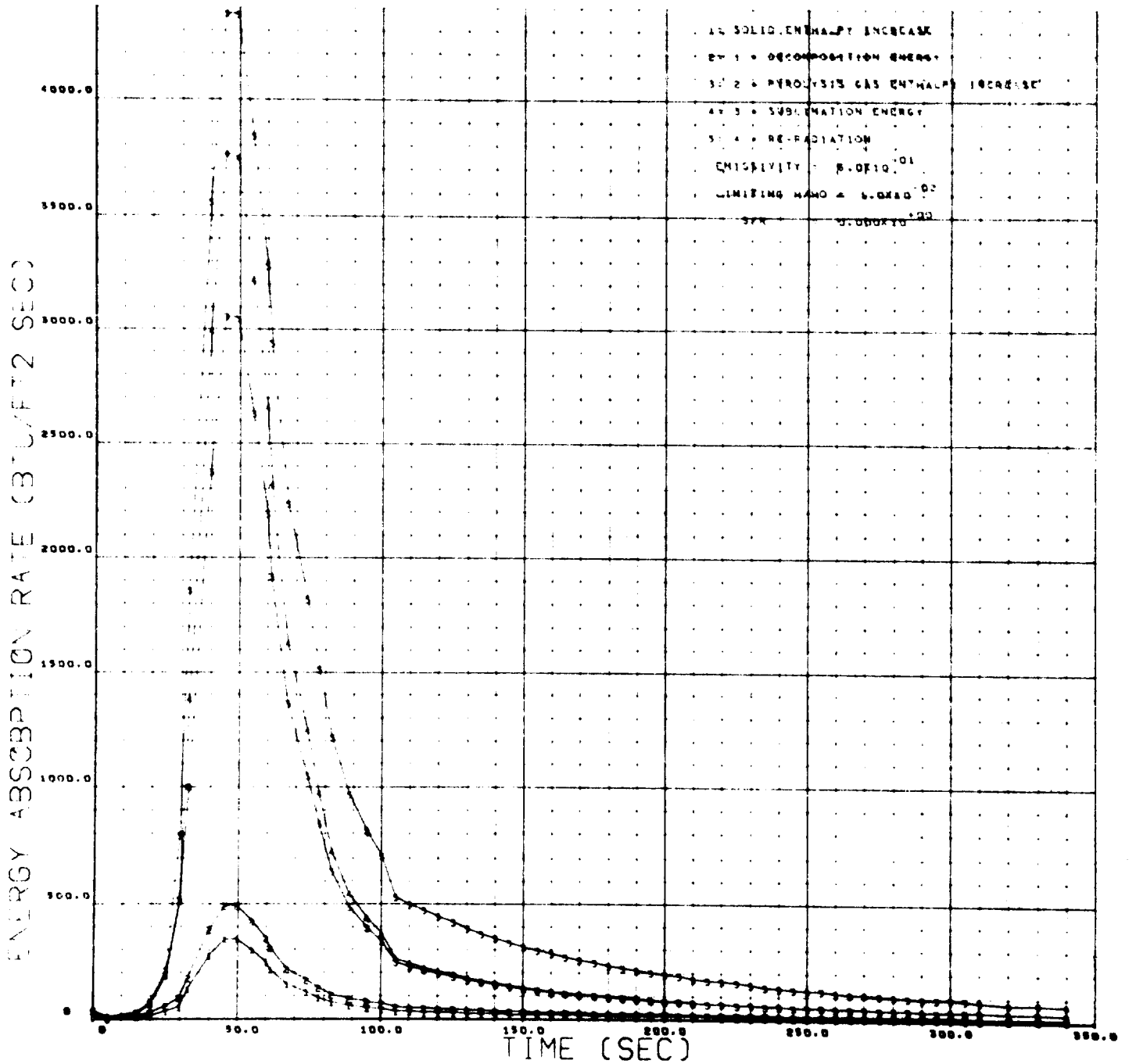


FIGURE B12

HEATING RATE HISTORY

LOWER BOUNDARY - VE=5000 - TRAJECTORY LB-38 AND LB-37

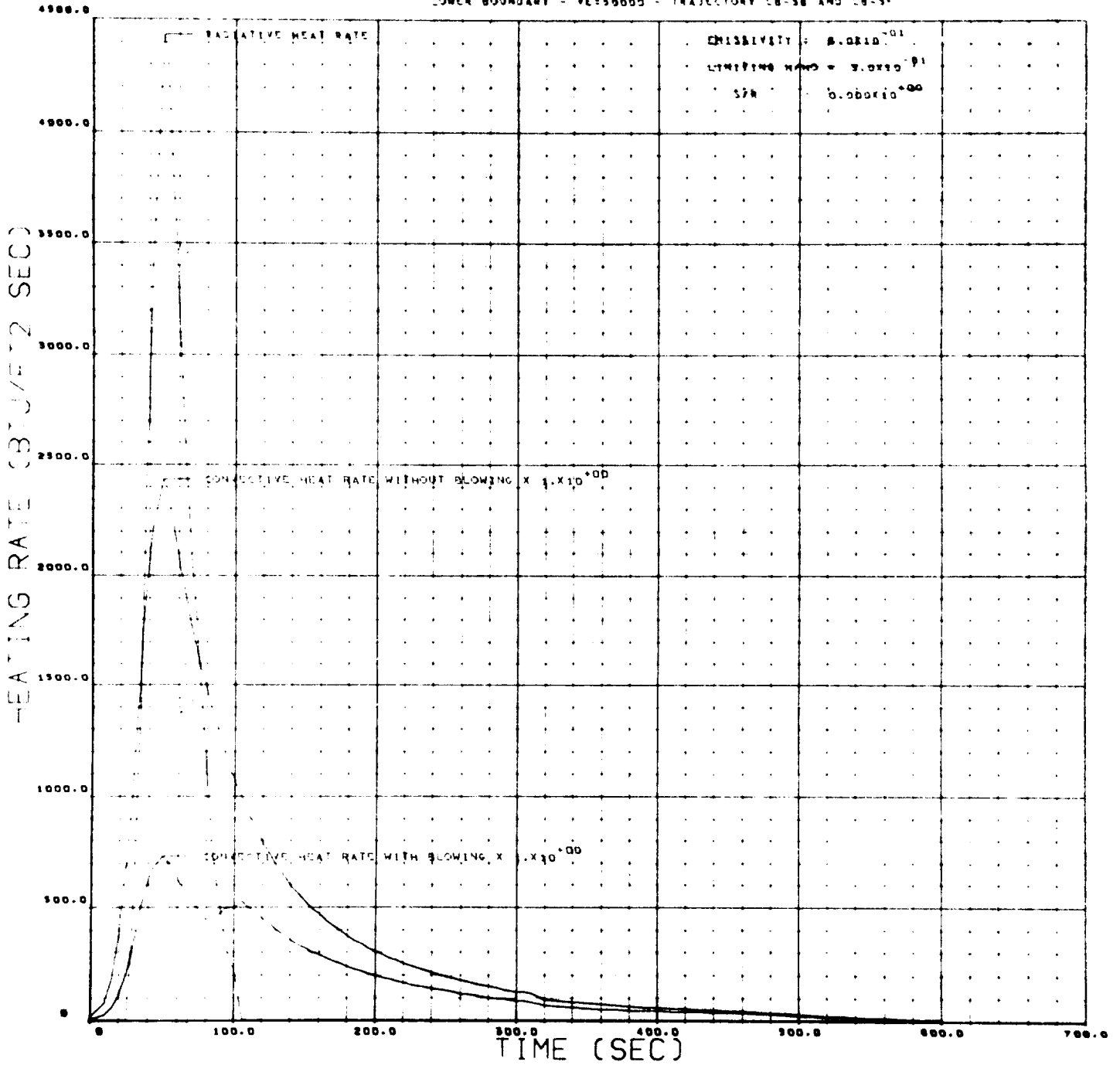


FIGURE B12

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VE=50000 - TRAJECTORY LE-55 AND LE-57

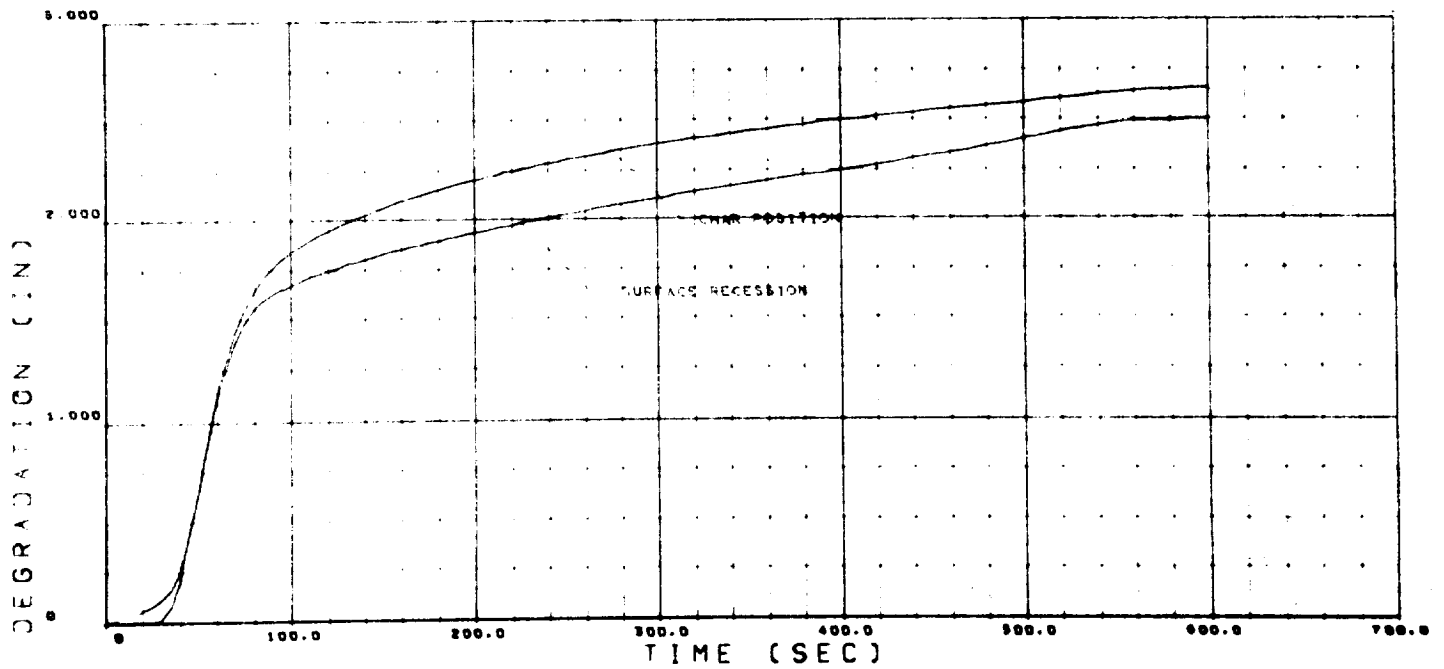
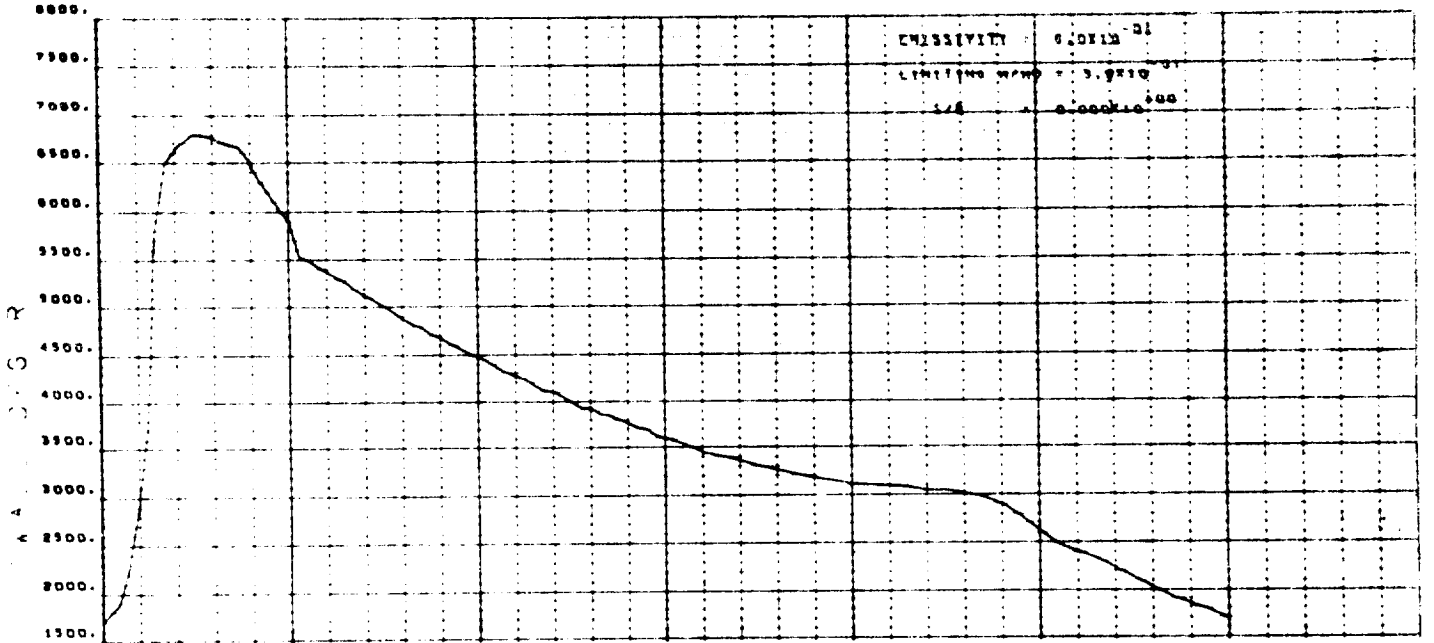


FIGURE B12

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=50000 - TRAJECTORY LB-5B AND LB-5F

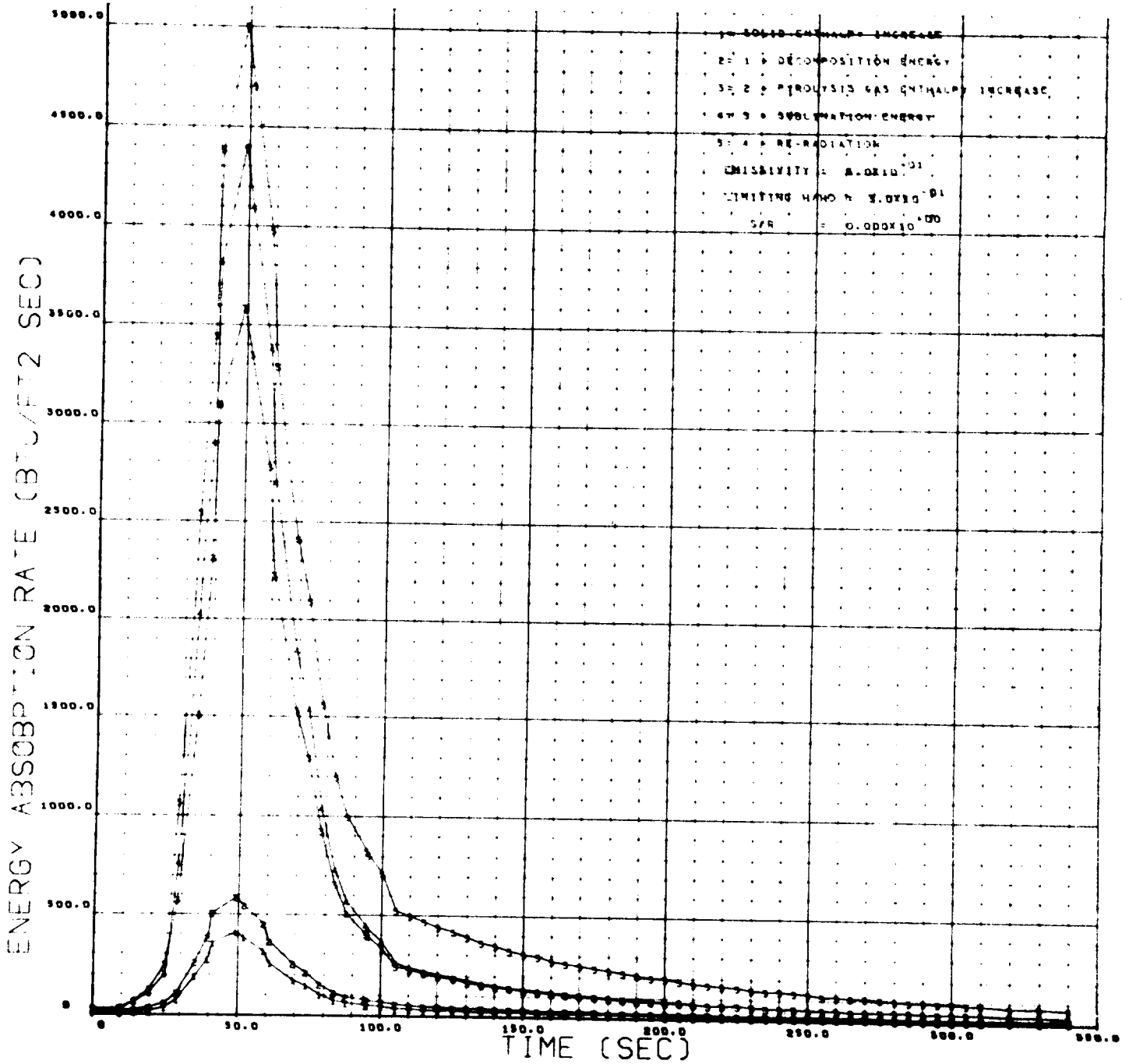


FIGURE B 13

HEATING RATE HISTORY

LOWER BOUNDARY - VE=50000 - TRAJECTORY LB-55 AND LB-57

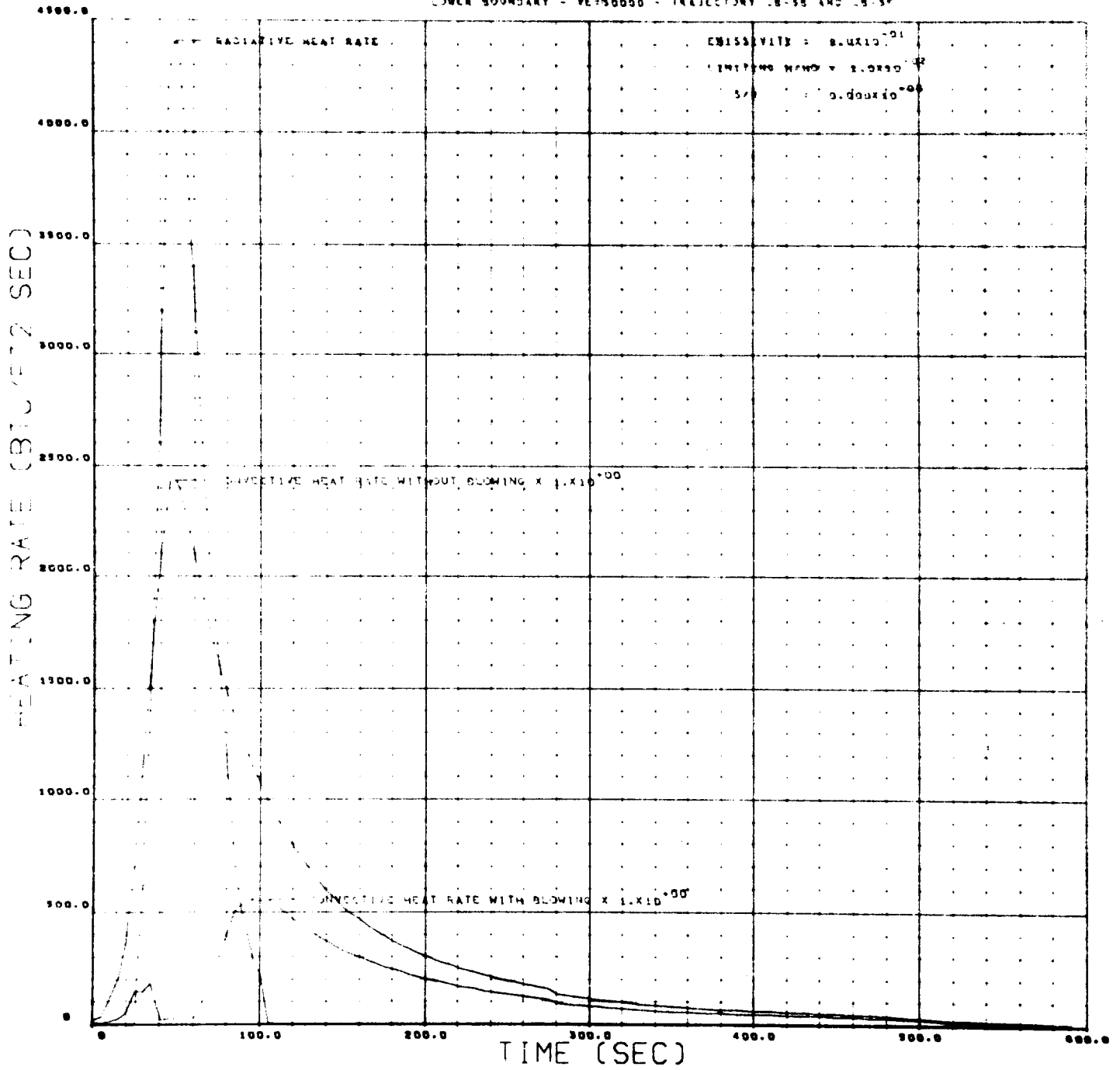


FIGURE B13

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VE=50000 - TRAJECTORY 13-58 AND 13-57

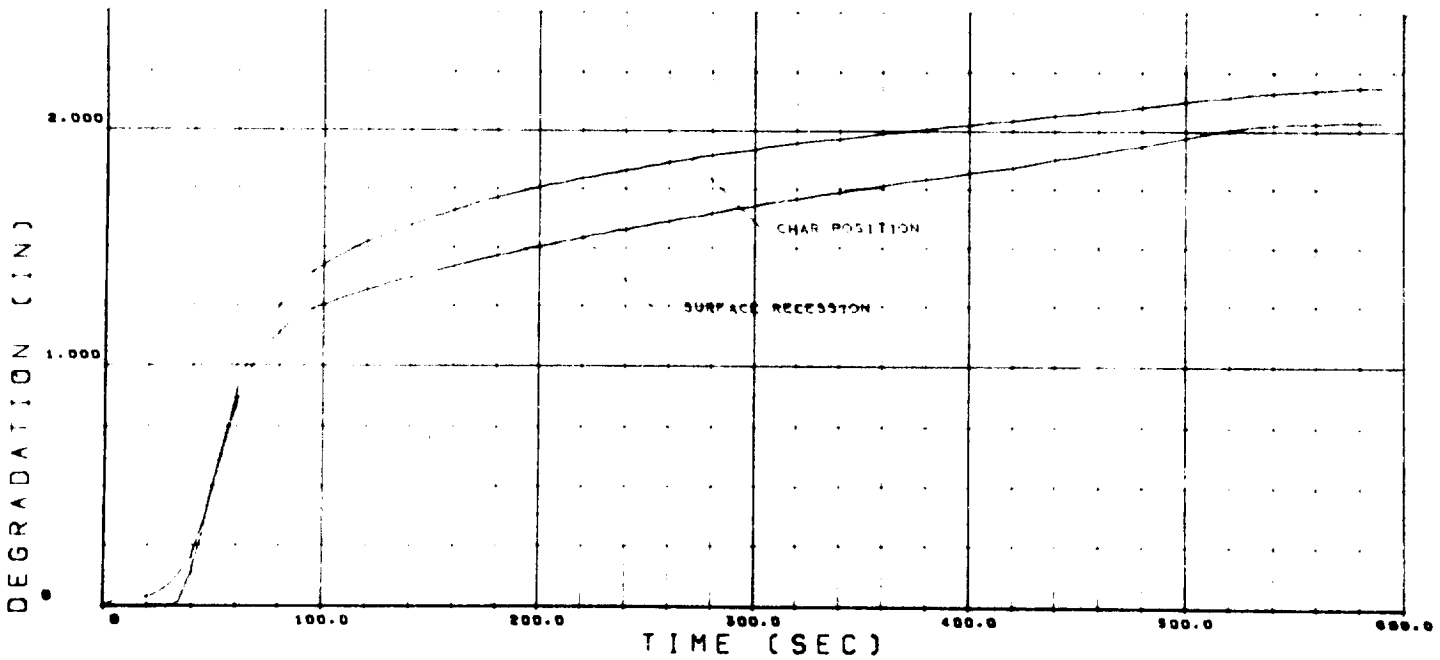
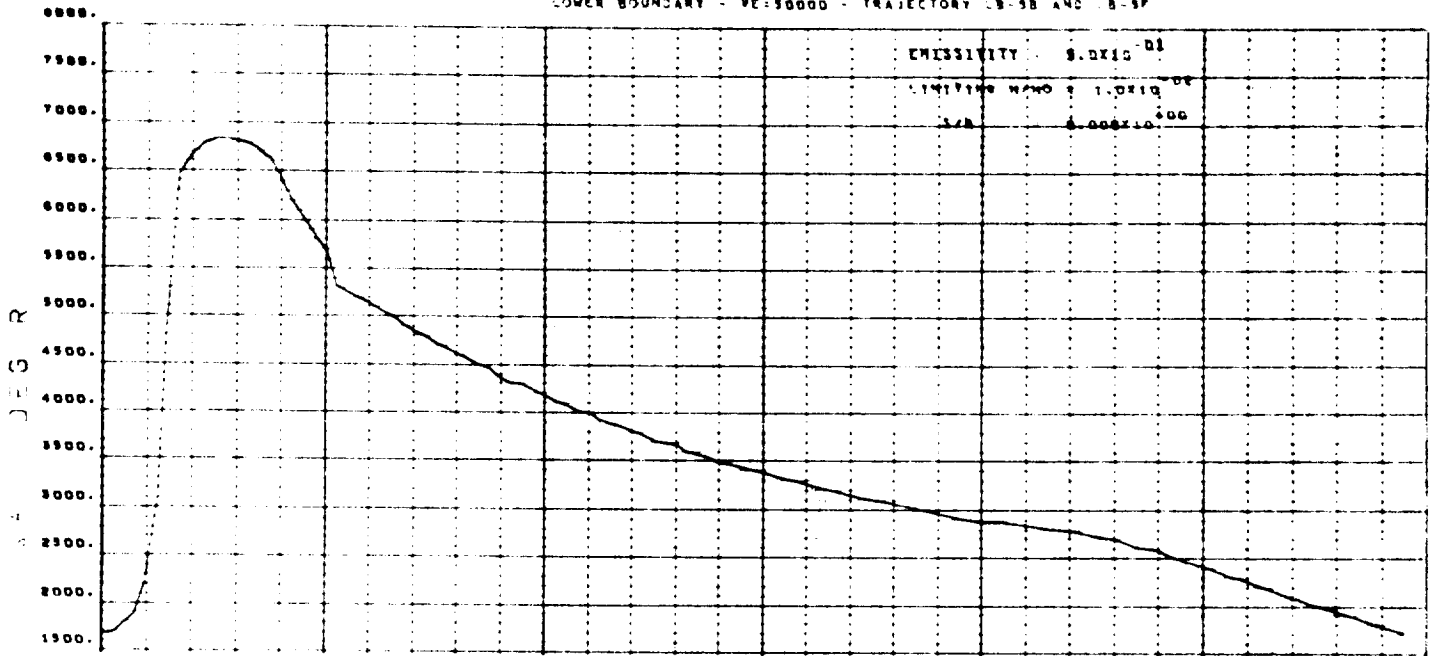


FIGURE B13

ENERGY ACCOMMODATION MECHANISMS

OVER BOUNDARY - VE=90000 - TRAJECTORY LB-50 AND LB-57

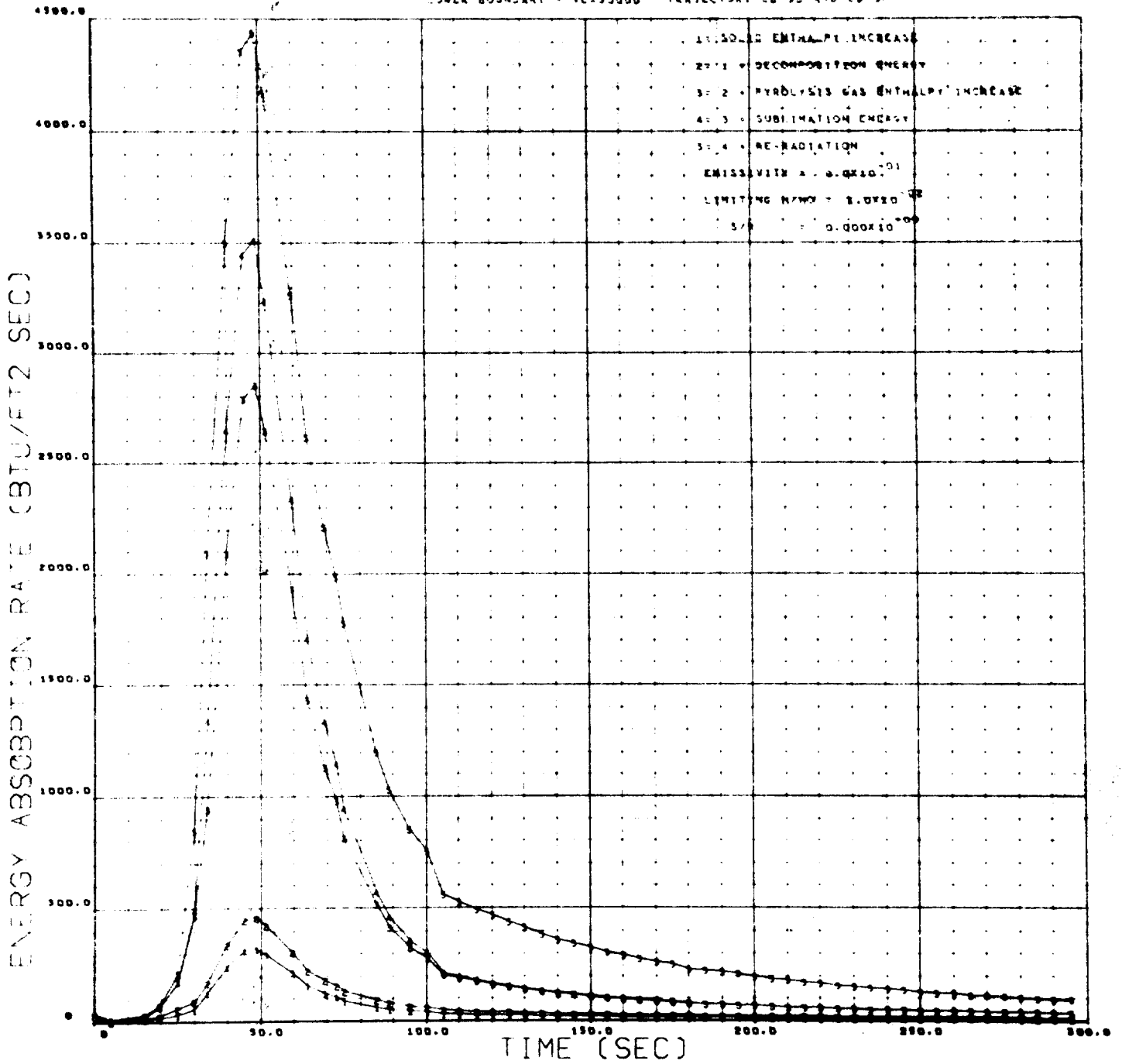


FIGURE B14

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VE=30000 - TRAJECTORY LB-98 AND LB-57

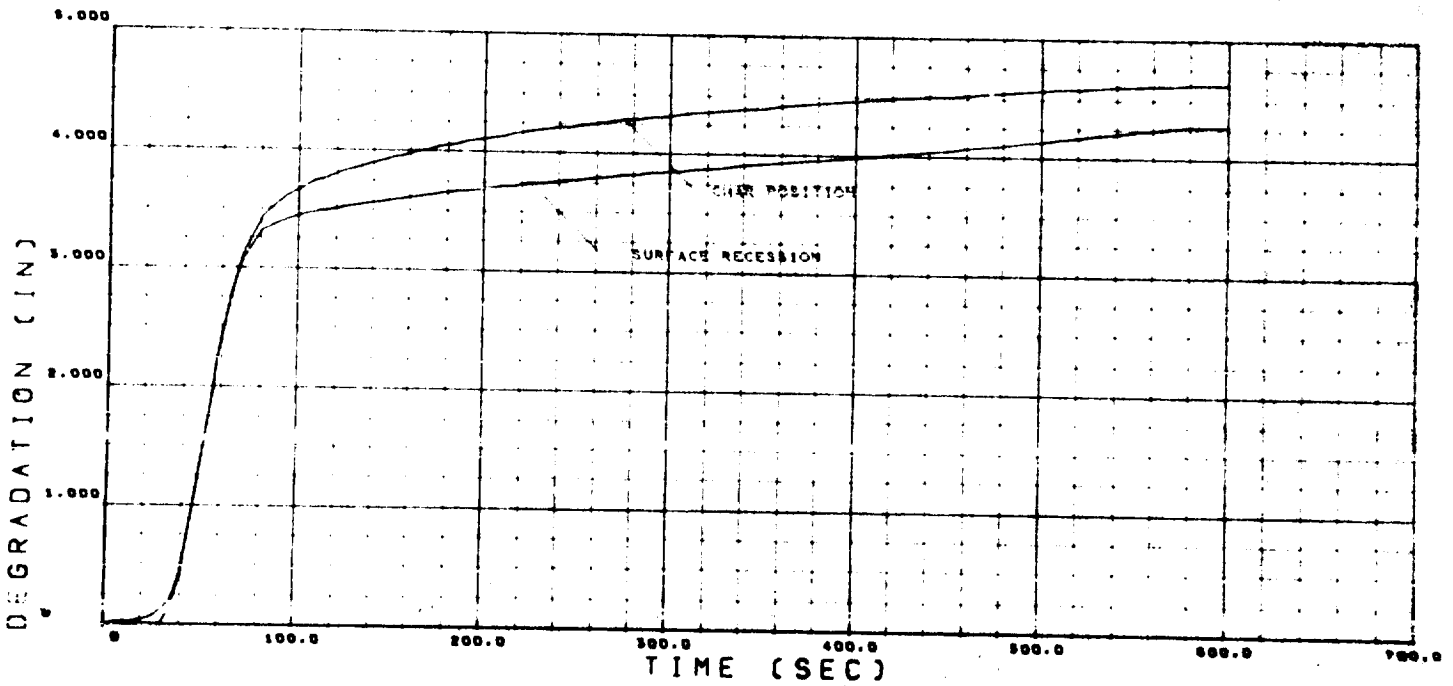
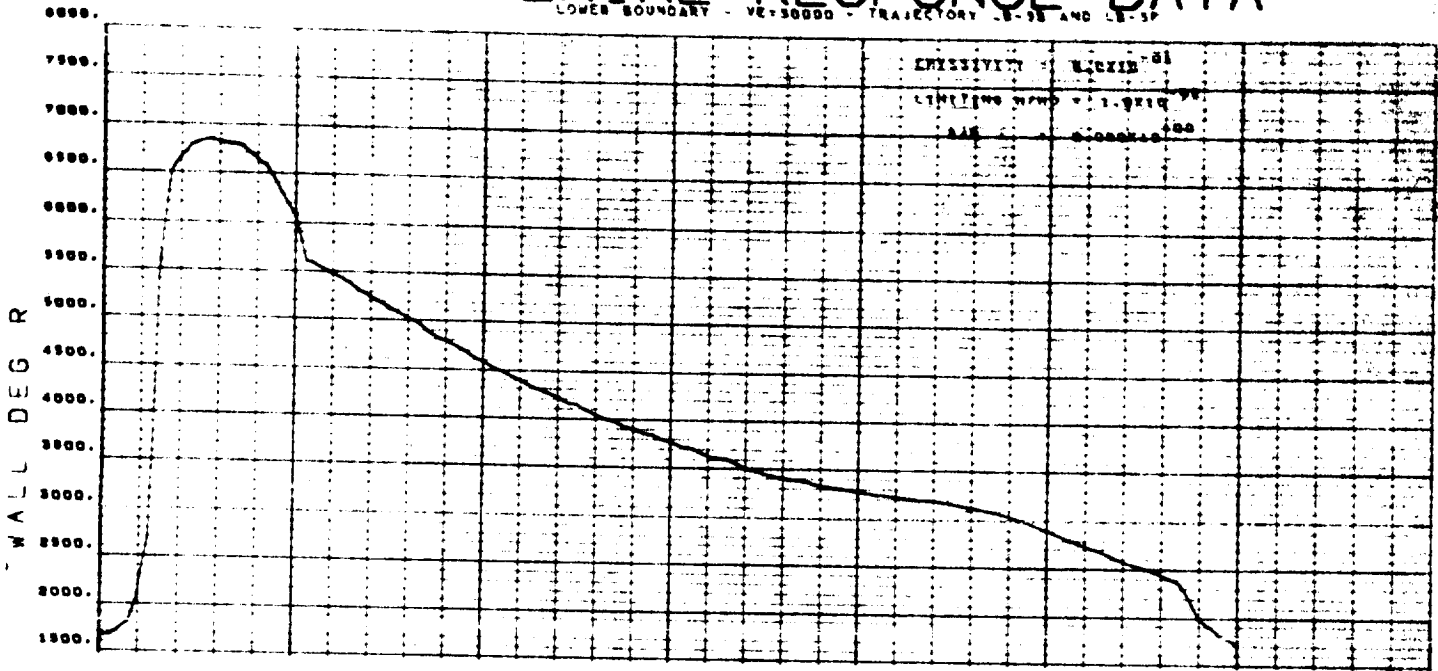


FIGURE B14

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=50000 - TRAJECTORY LB-58 AND LB-57

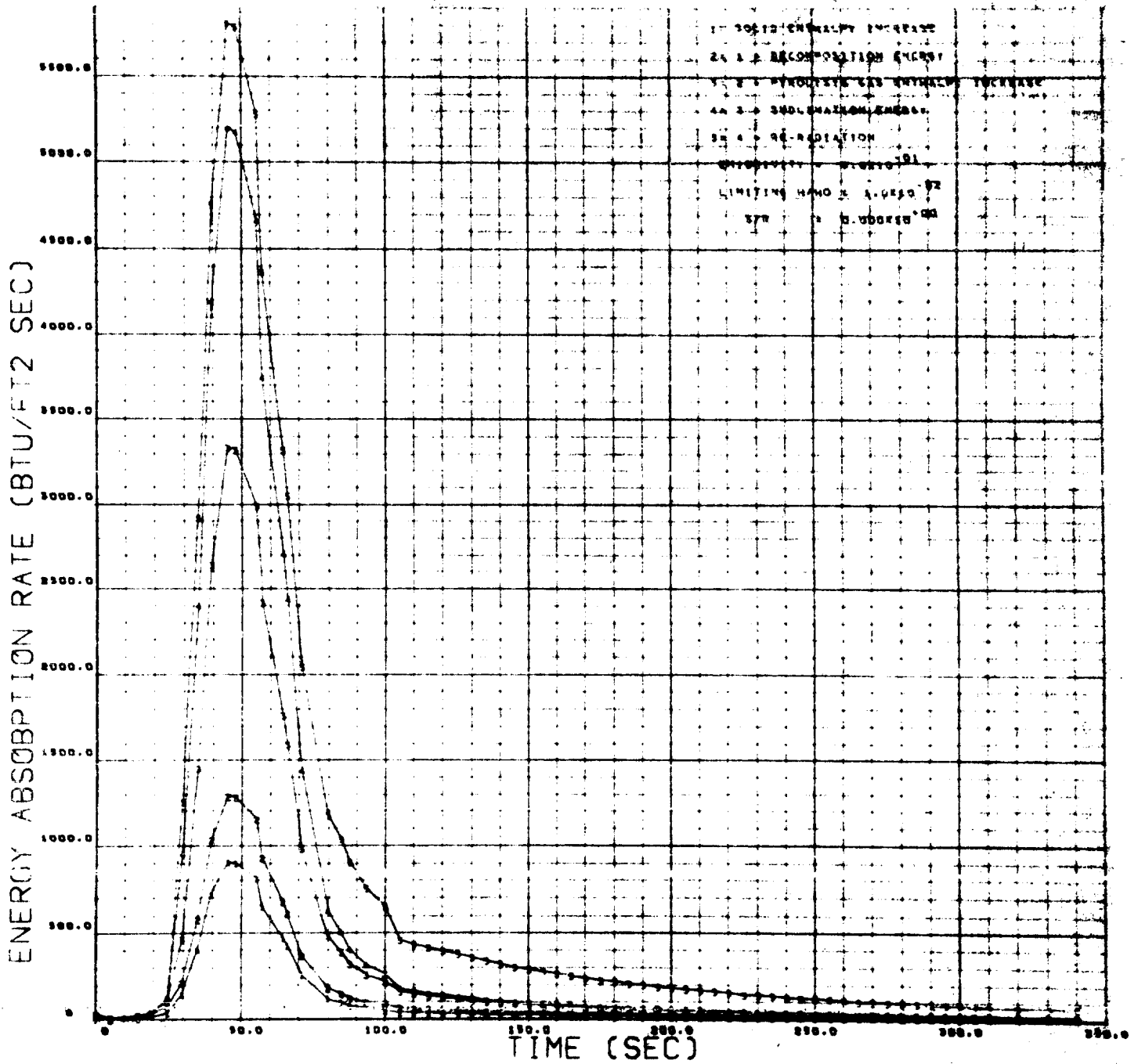


FIGURE B14

HEATING RATE HISTORY

LOWER BOUNDARY - VE=50000 - TRAJECTORY LB-28 AND LB-37

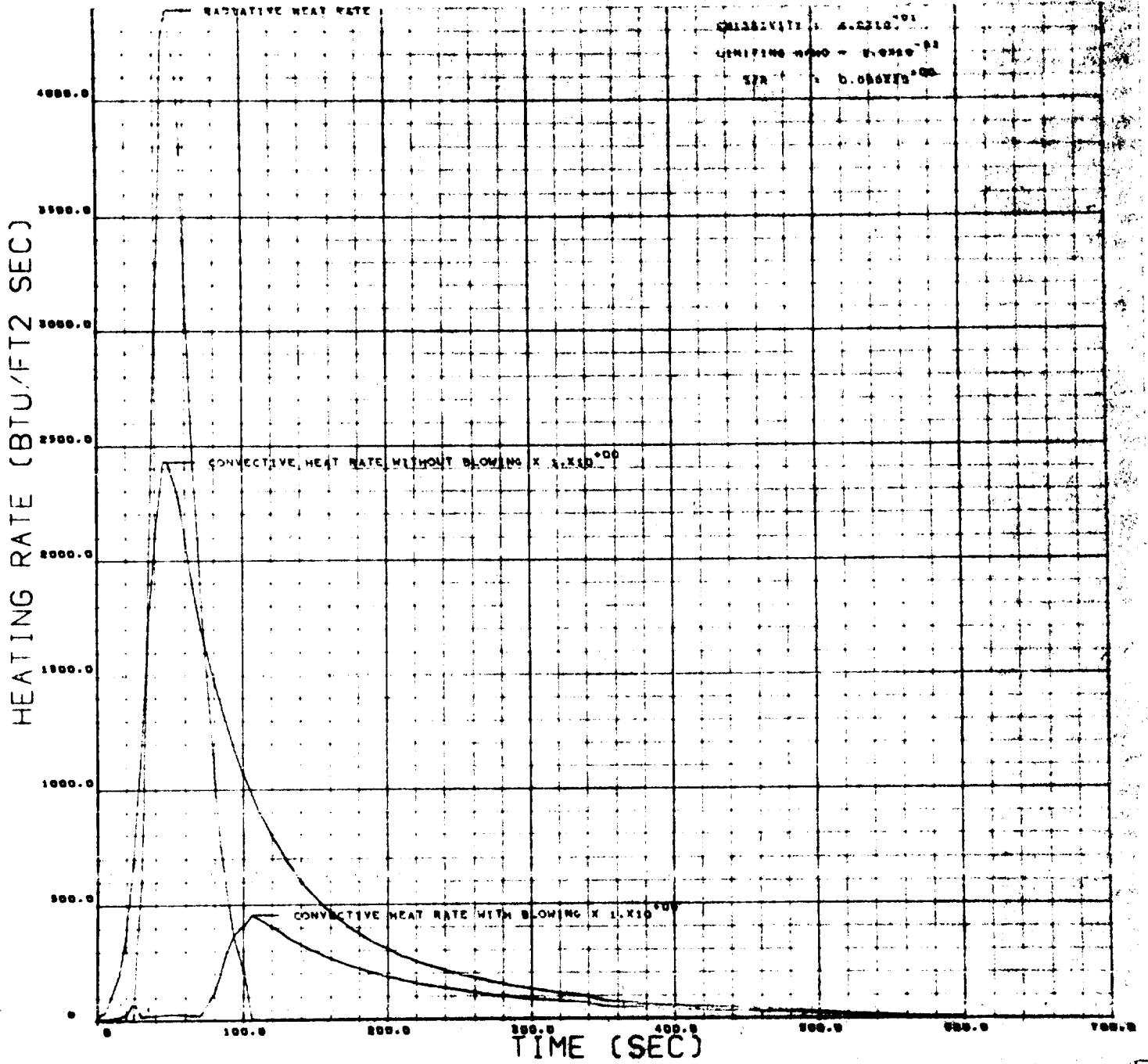


FIGURE B15

HEATING RATE HISTORY

LOWER BOUNDARY - VE=50000 - TRAJECTORY LB-5B AND LB-5F

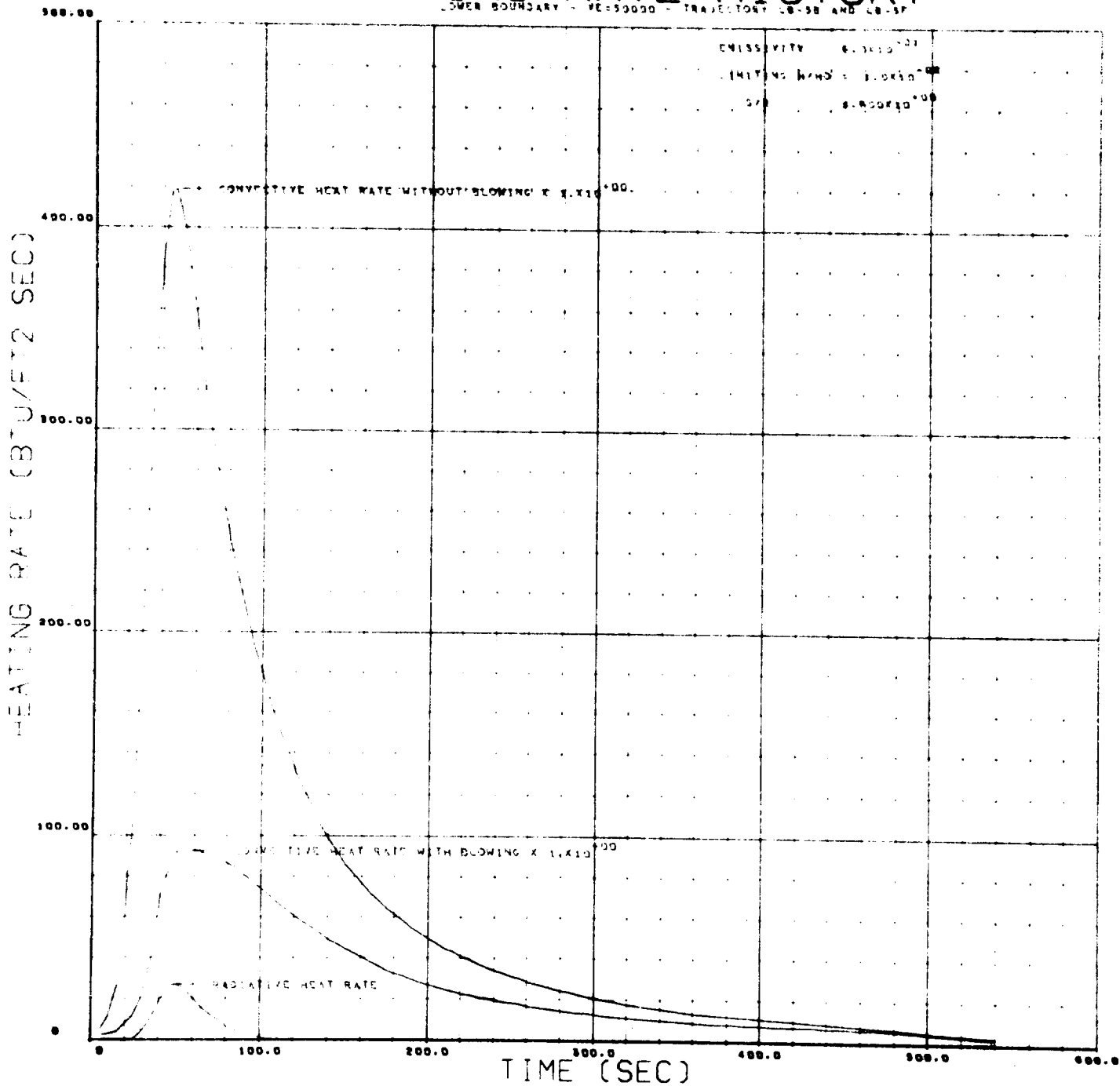


FIGURE B15

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VE=50000 - TRAJECTORY LB-38 AND LB-37

CRESSIVITY : 8.0E10 D1
 LIMITING WIND V 1.0E10 OF
 S/A : 4.80E10 000

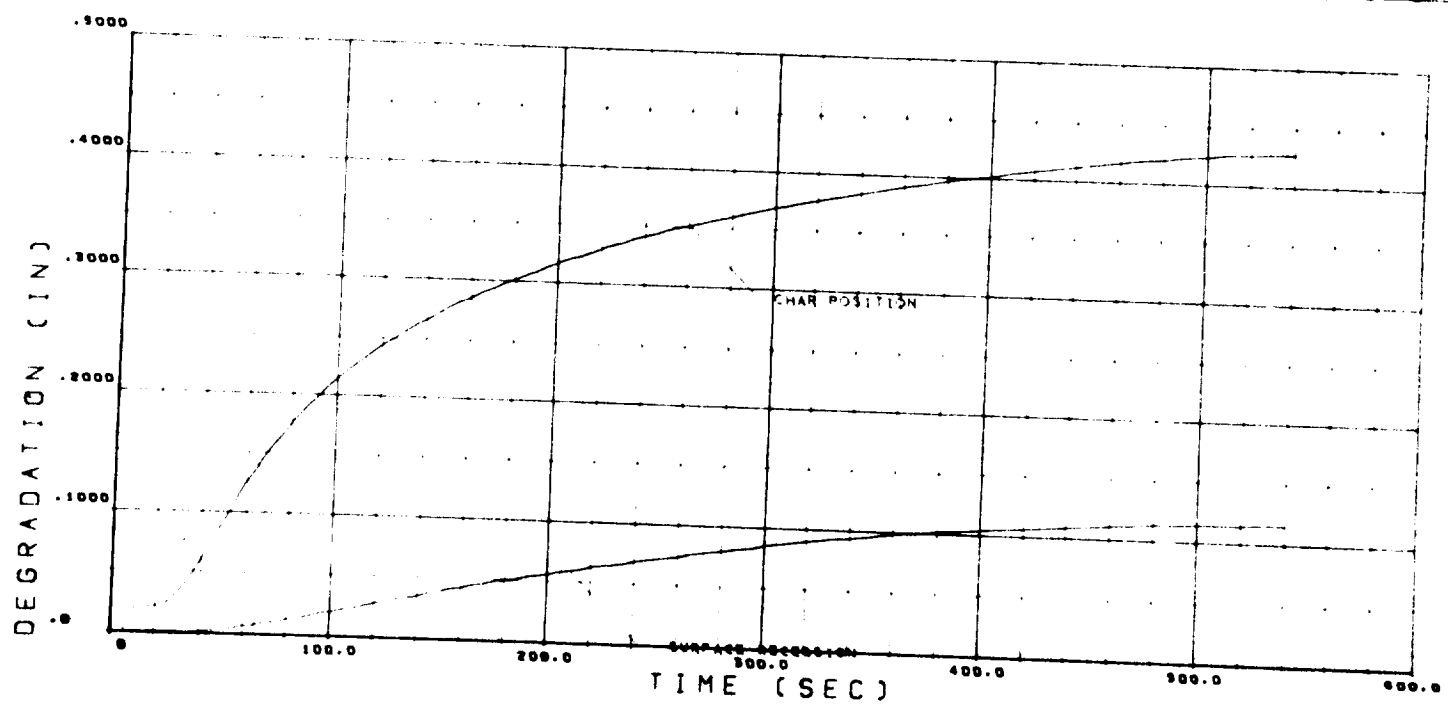
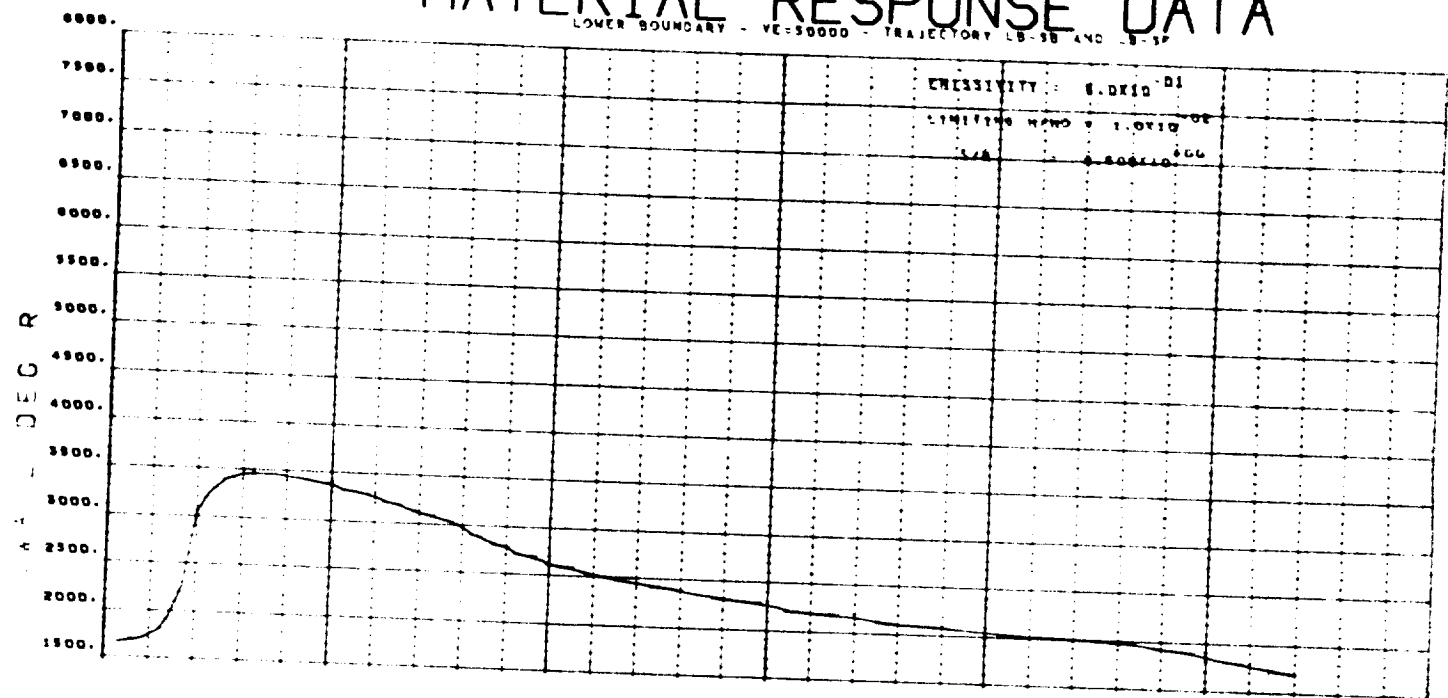


FIGURE B15

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=50000 - TRAJECTORY LB-38 AND LB-37

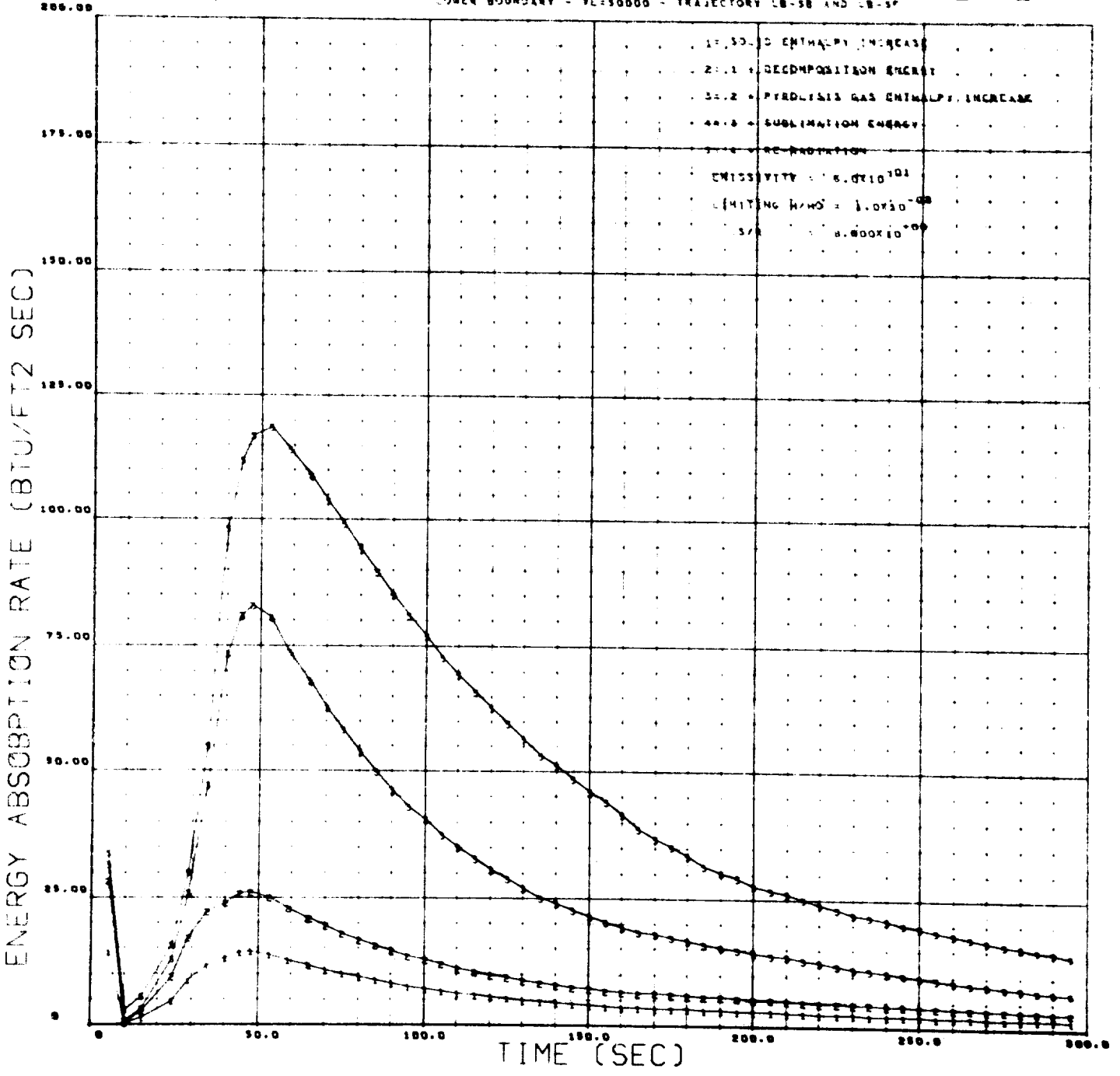


FIGURE B16

HEATING RATE HISTORY

LOWER BOUNDARY - VE=30000 - TRAJECTORY LB-38 AND LB-37

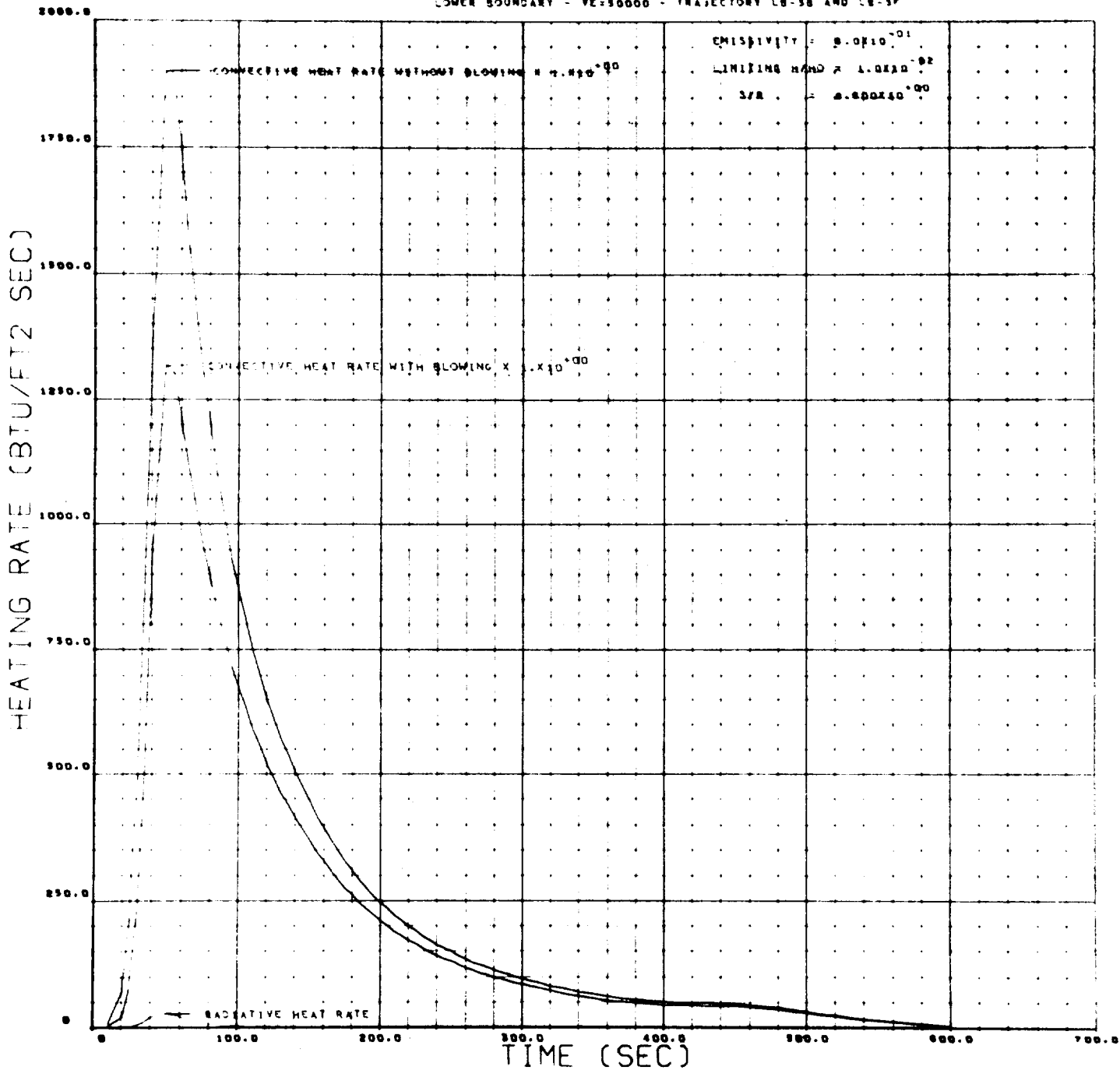


FIGURE B16

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VE=50000 - TRAJECTORY LB-35 AND LB-37

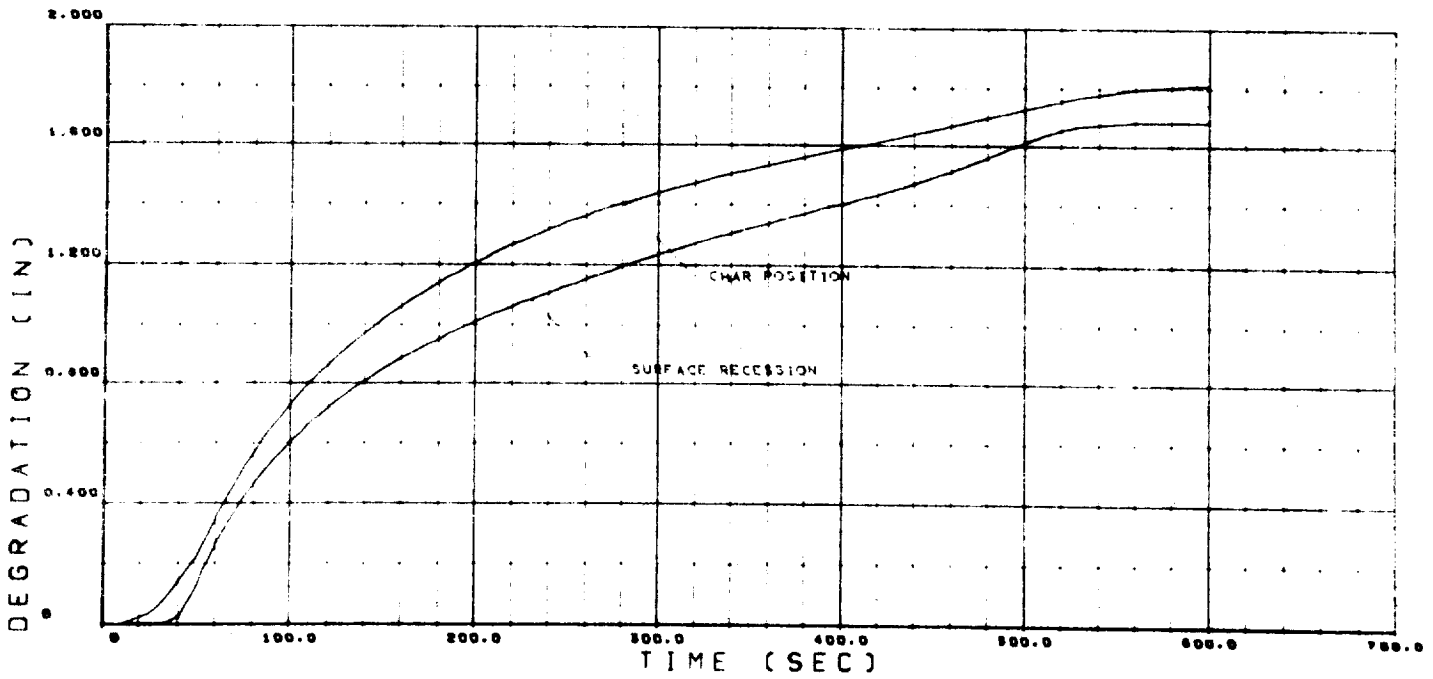
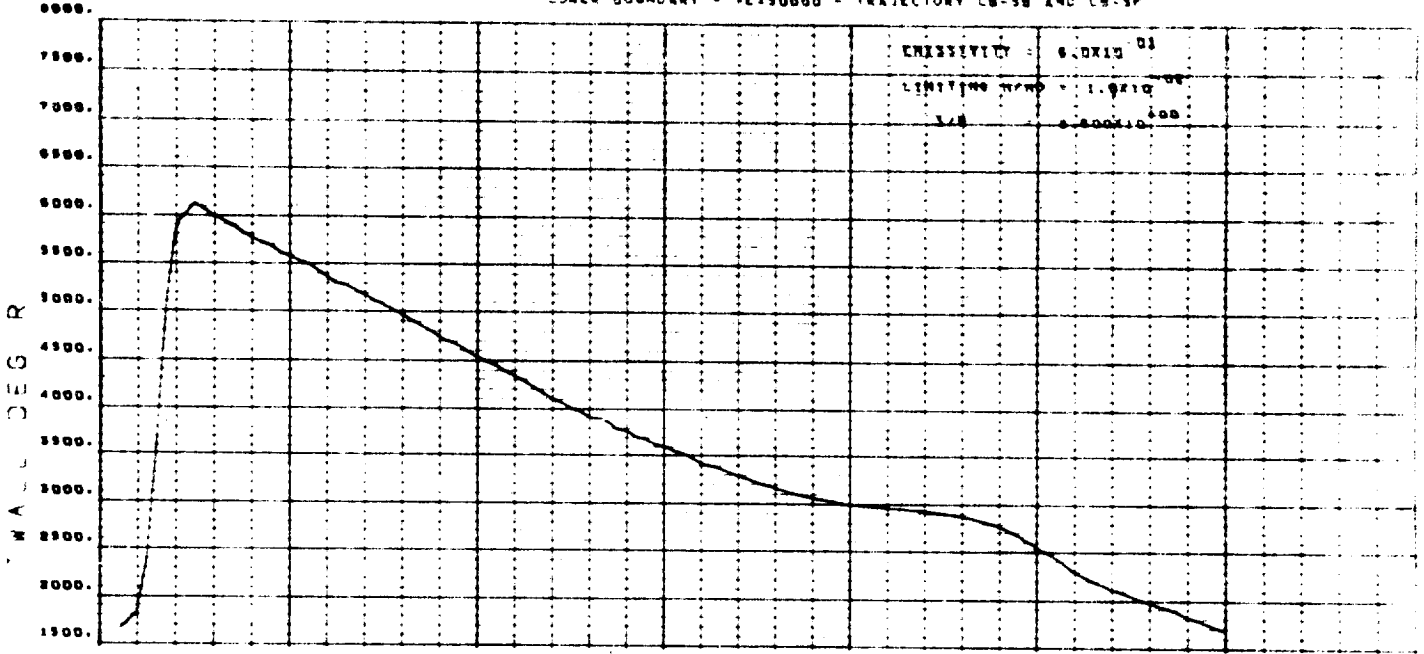


FIGURE B/6

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=30000 - TRAJECTORY - B-56 AND B-57

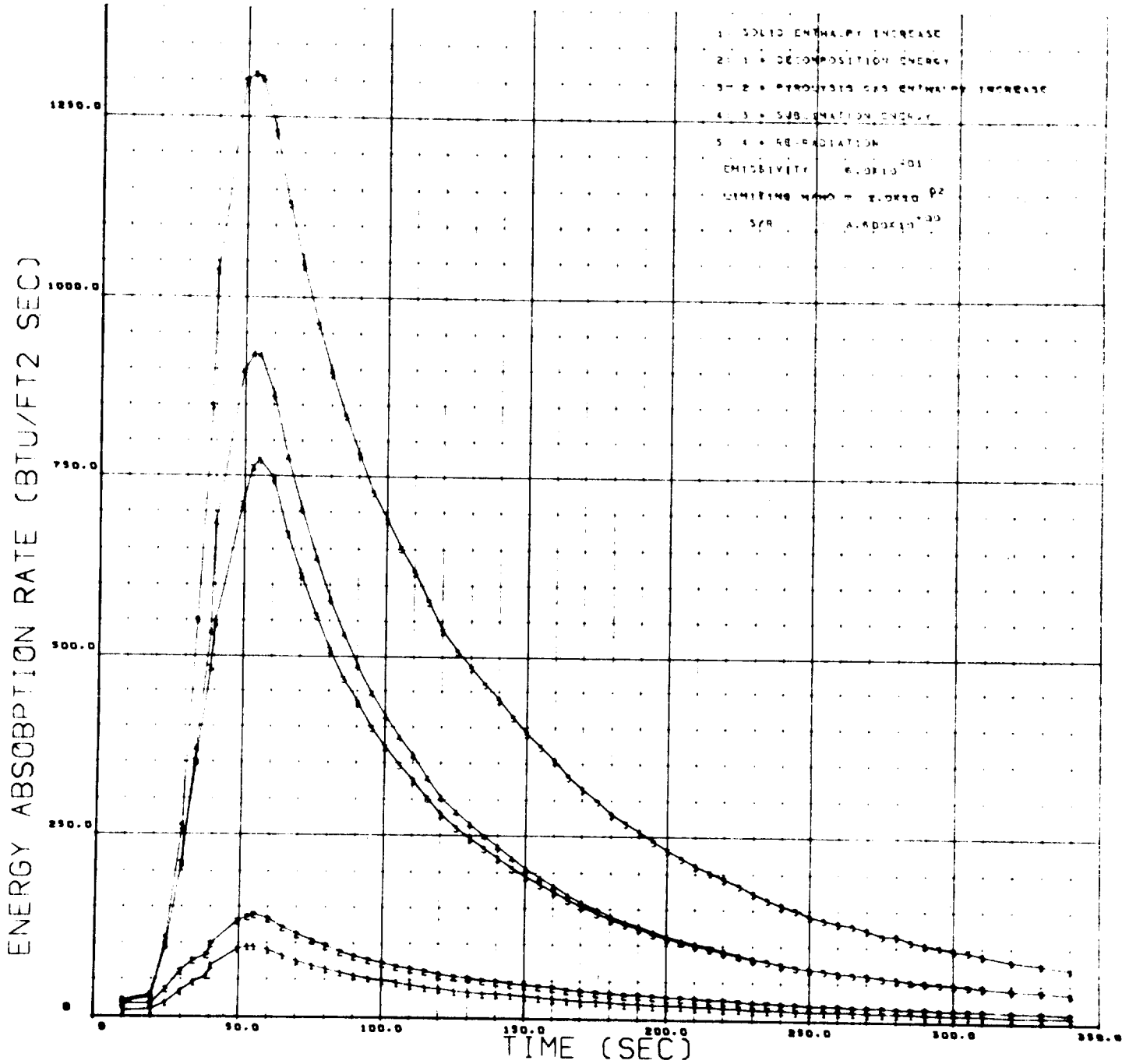


FIGURE B17

HEATING RATE HISTORY

LOWER BOUNDARY - Y=50000 - TRAIL TUBE - P133 AND 134

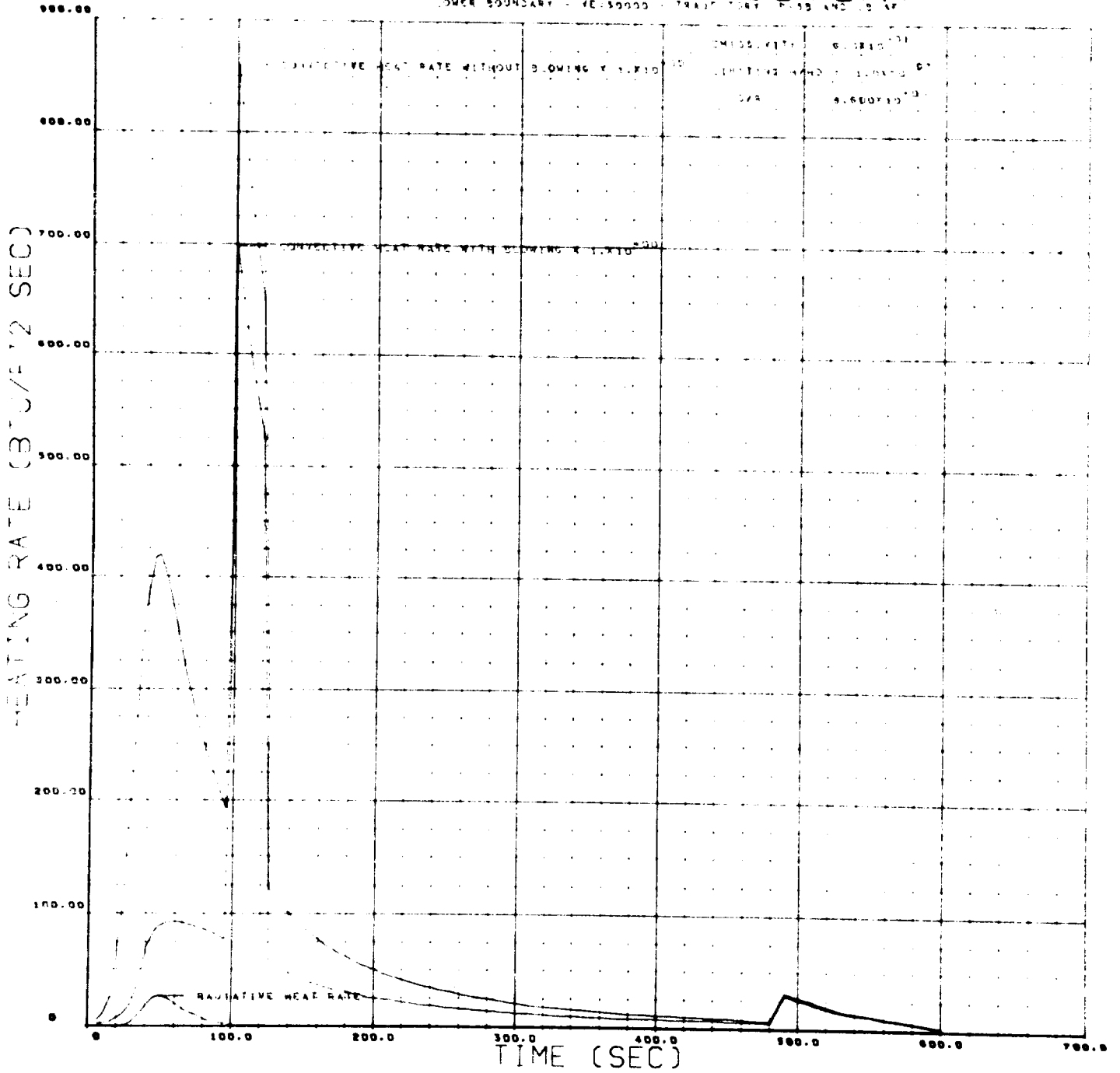


FIGURE B17

MATERIAL RESPONSE DATA

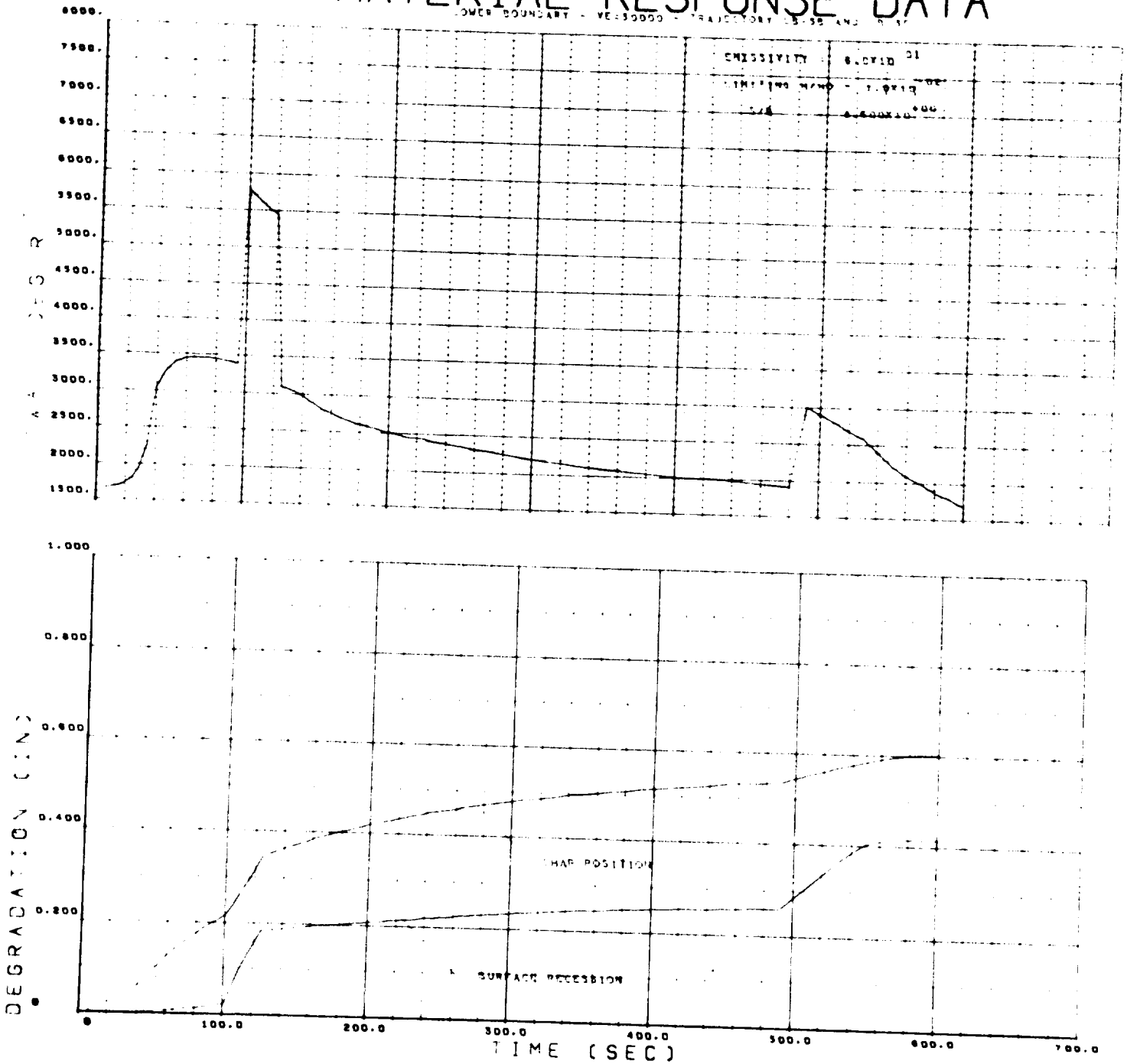


FIGURE B 17

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - YE-50000 - TRAJECTORY - B-33 AND -B-37

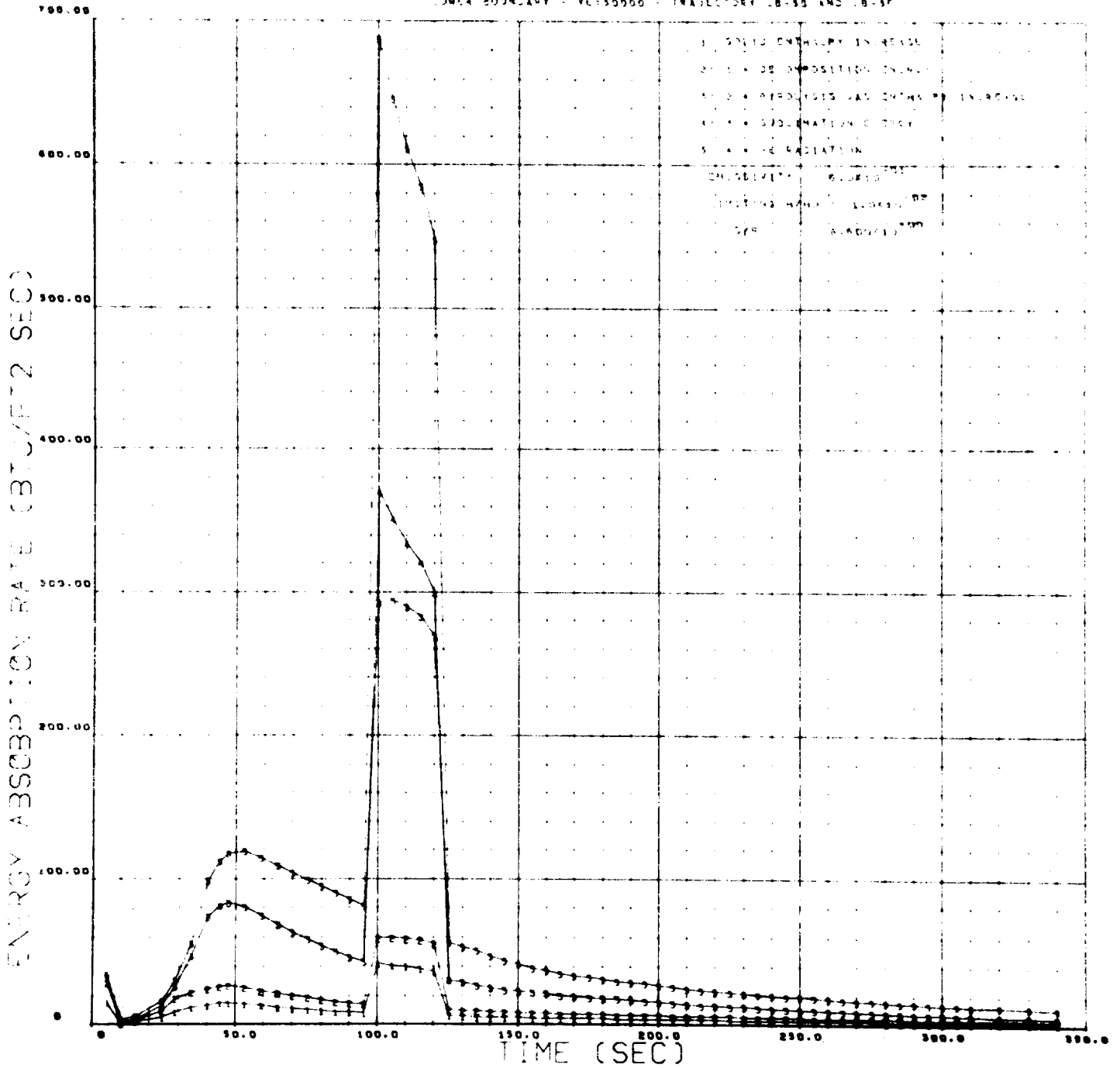


FIGURE B18

HEATING RATE HISTORY

LOWER BOUNDARY VELOCITY TRAJECTORY B-38 AND B-37

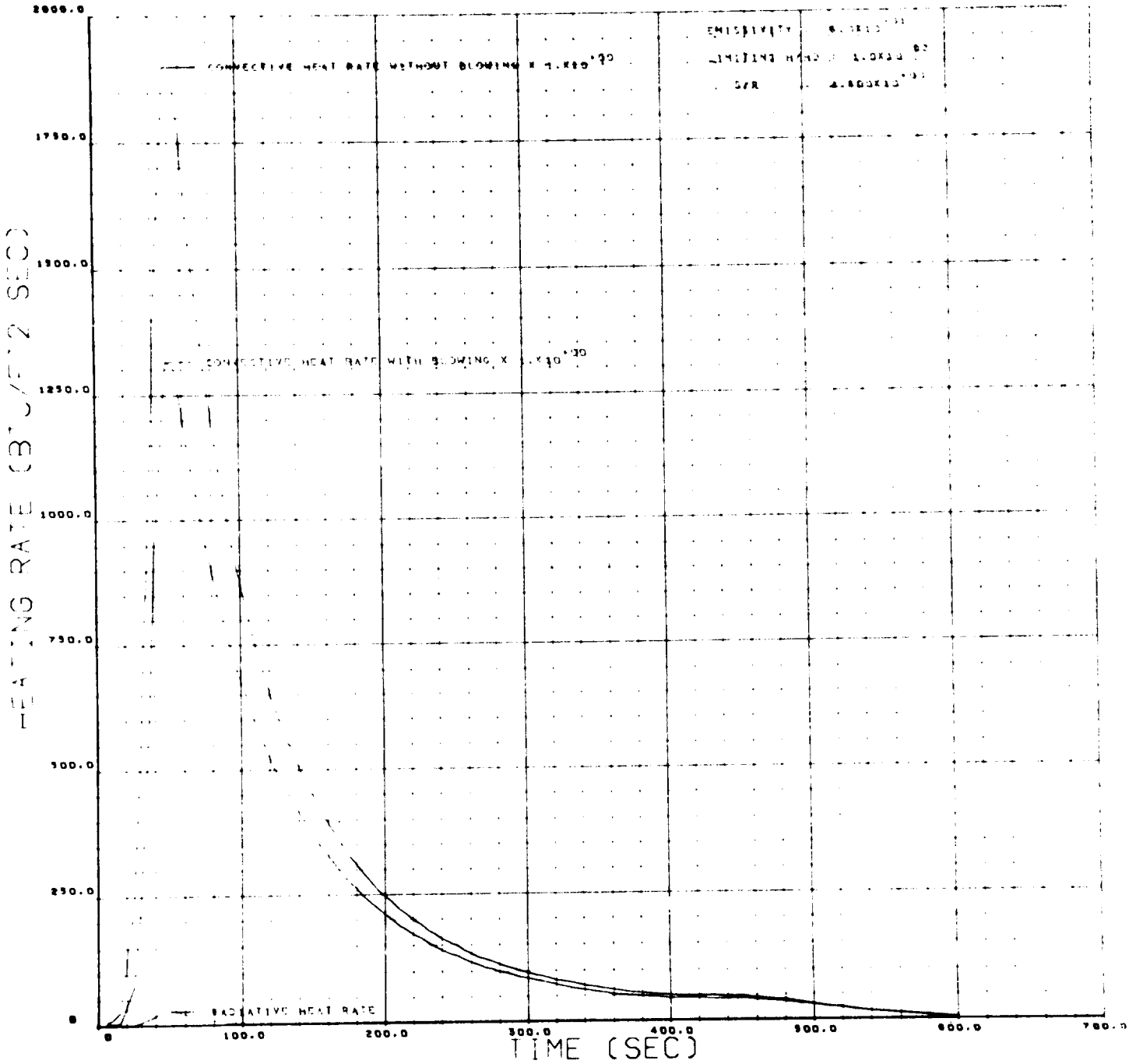
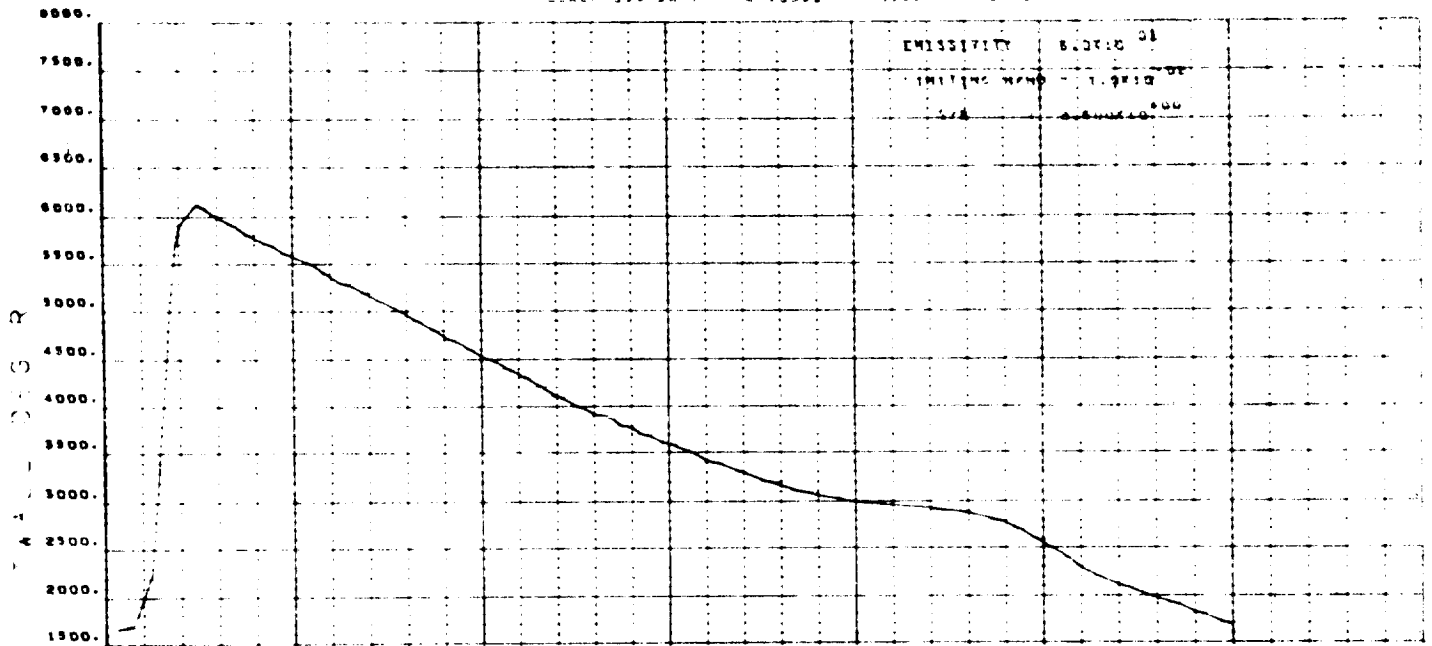


FIGURE B18

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VE=50000 - TRAJECTORY B-18 AND B-17



EMISSIVITY 0.2000
MELTING POINT 1.9210
DENSITY 0.0000

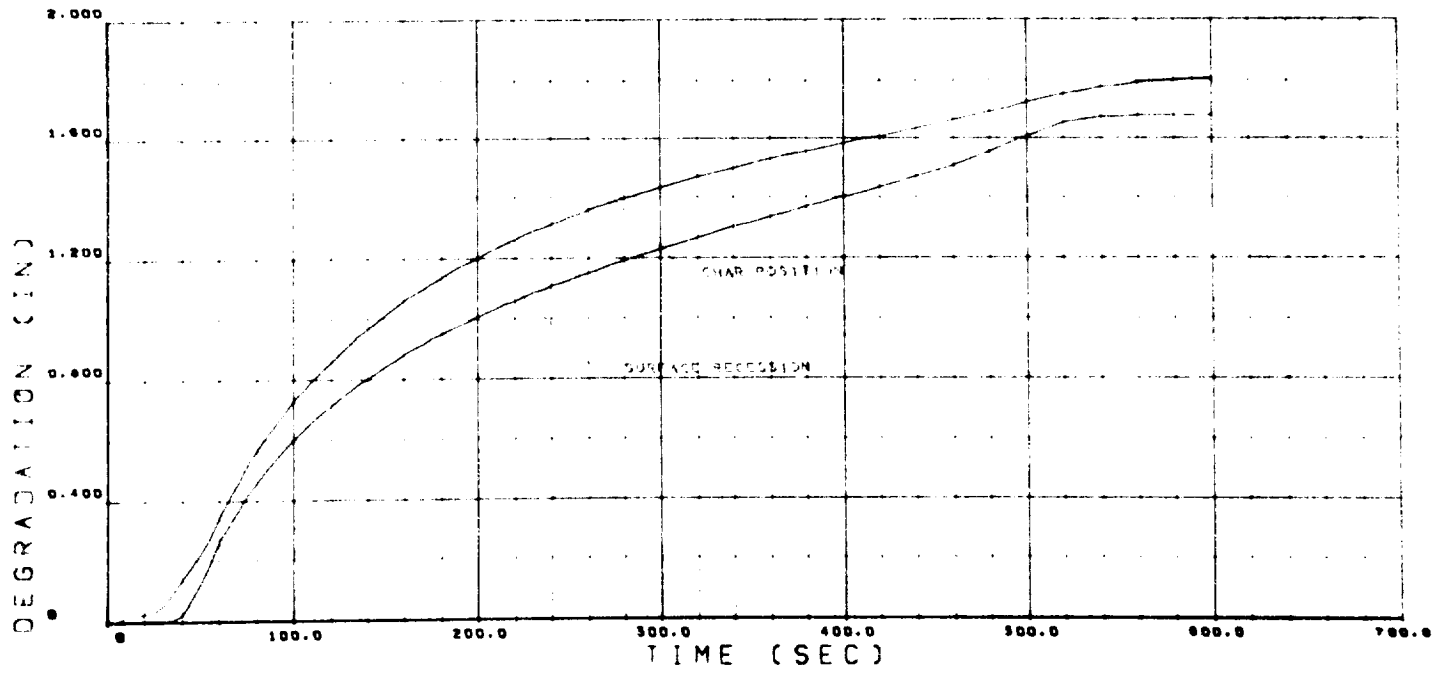


FIGURE 4B8

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=50000 - TRAJECTORY LB-38 AND LB-37

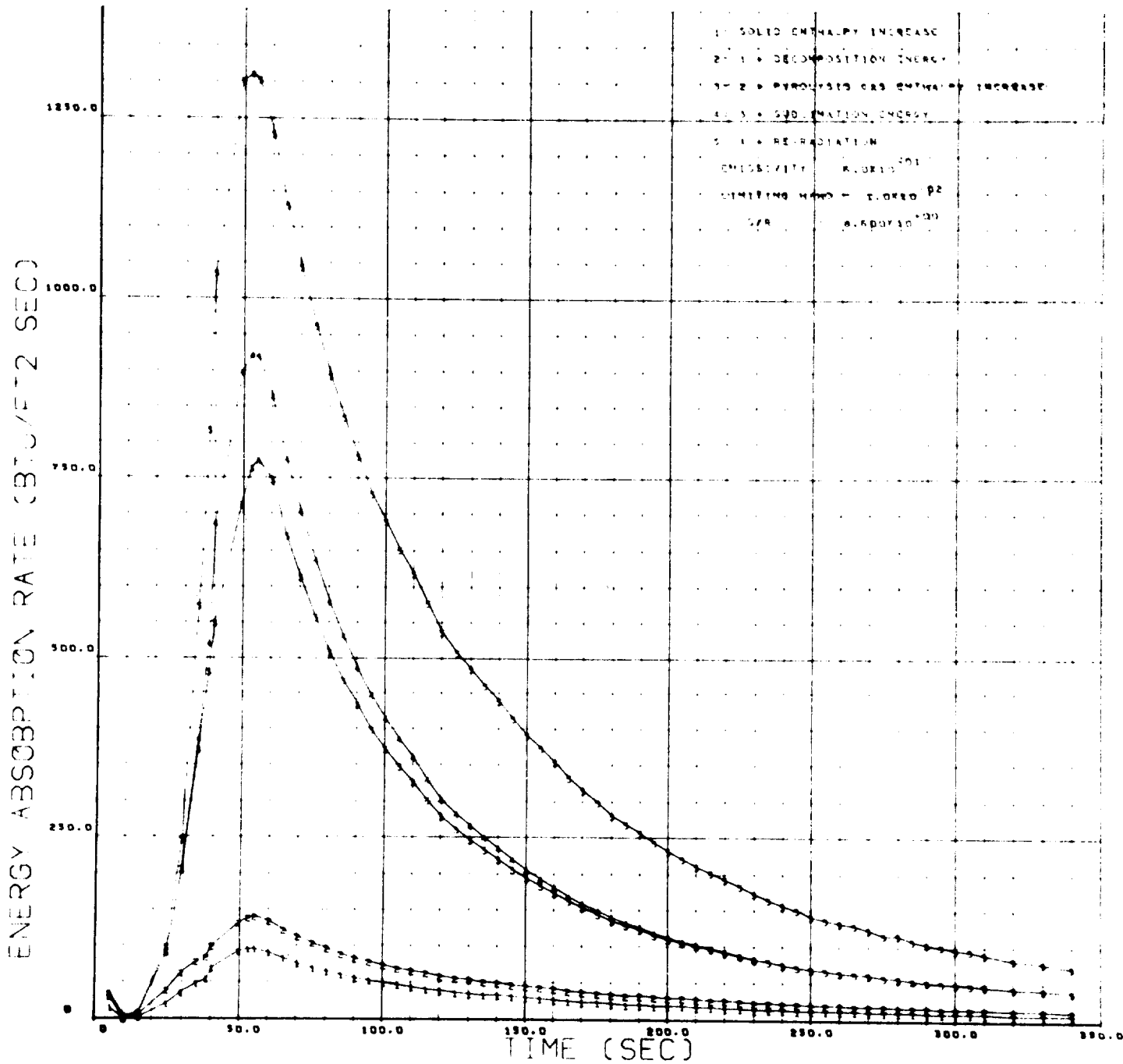


FIGURE B19

HEATING RATE HISTORY

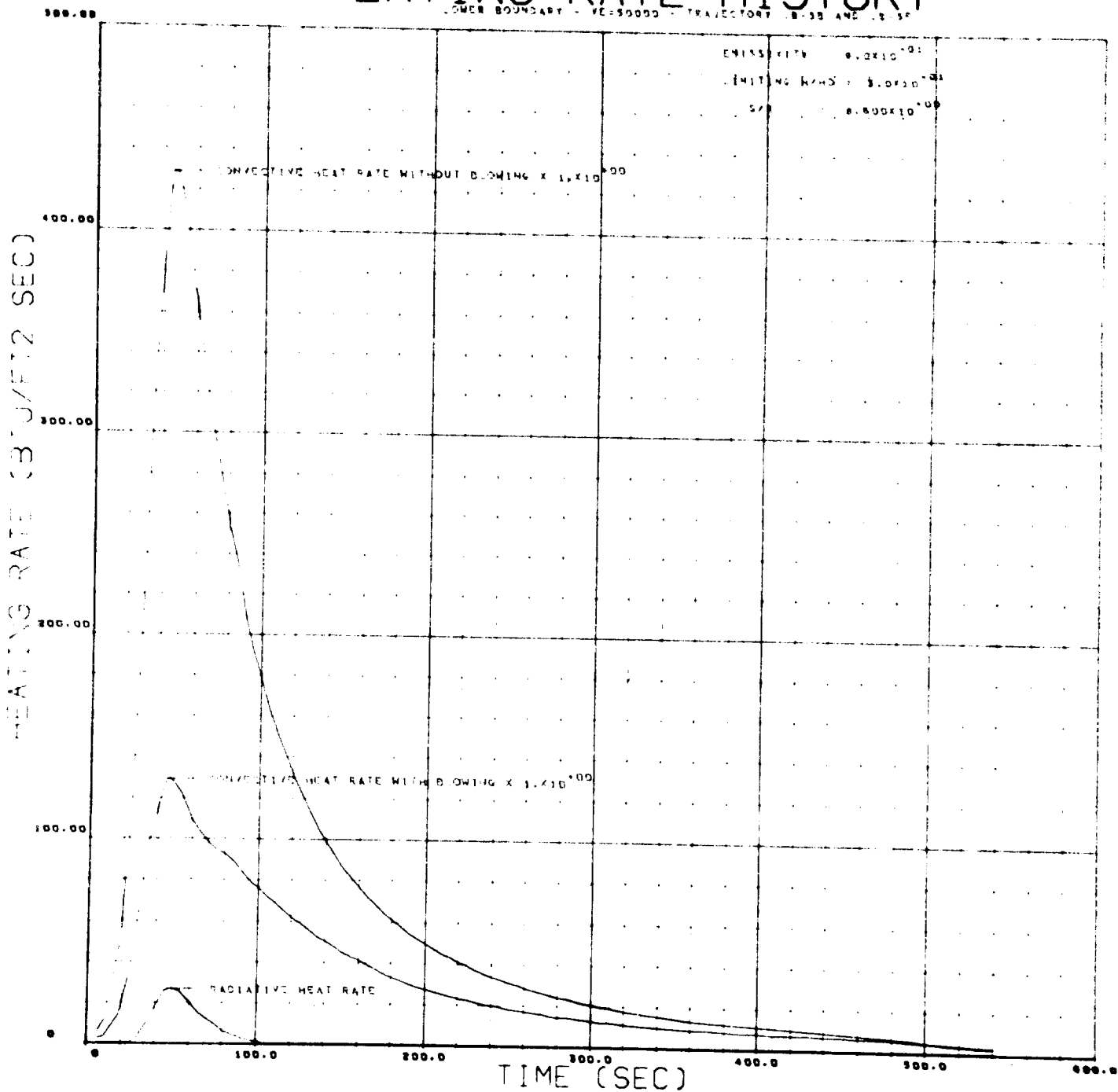


FIGURE B19

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VE=50000 - TRAJECTORY 1.6-38 AND 1.1-37

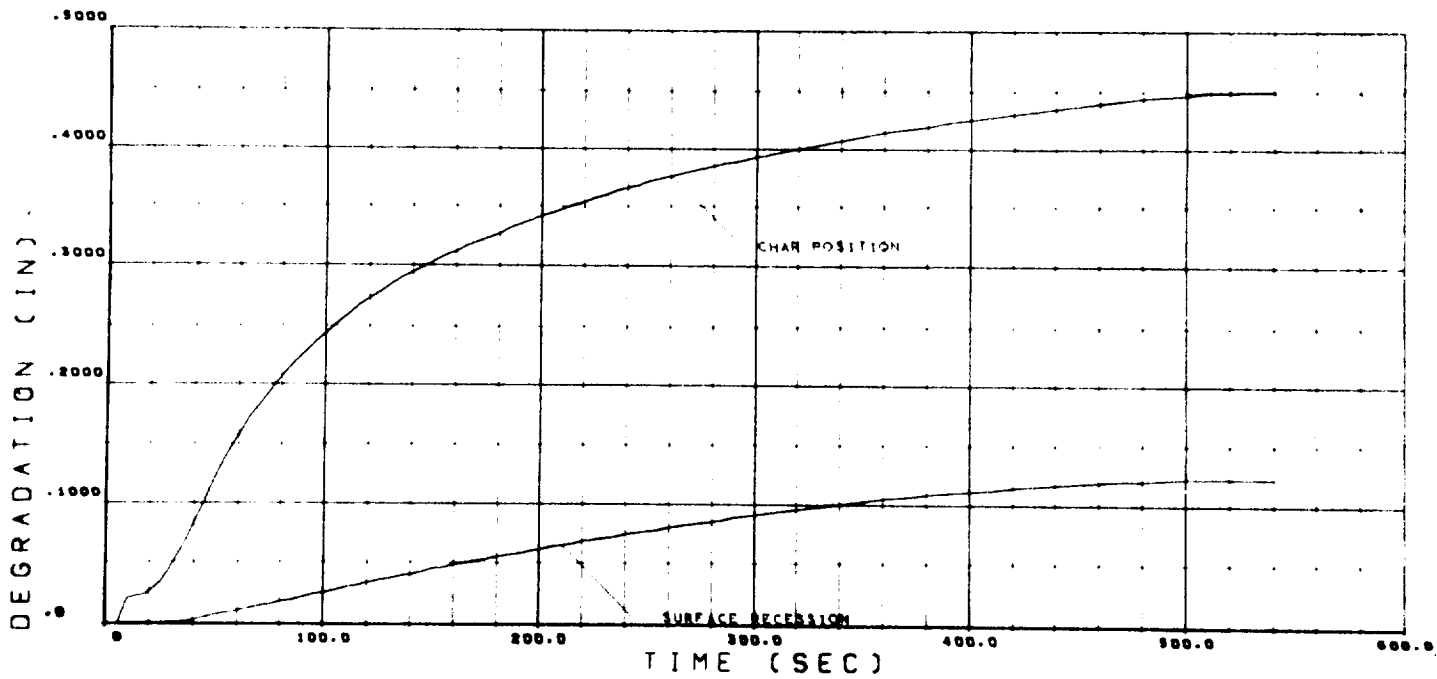
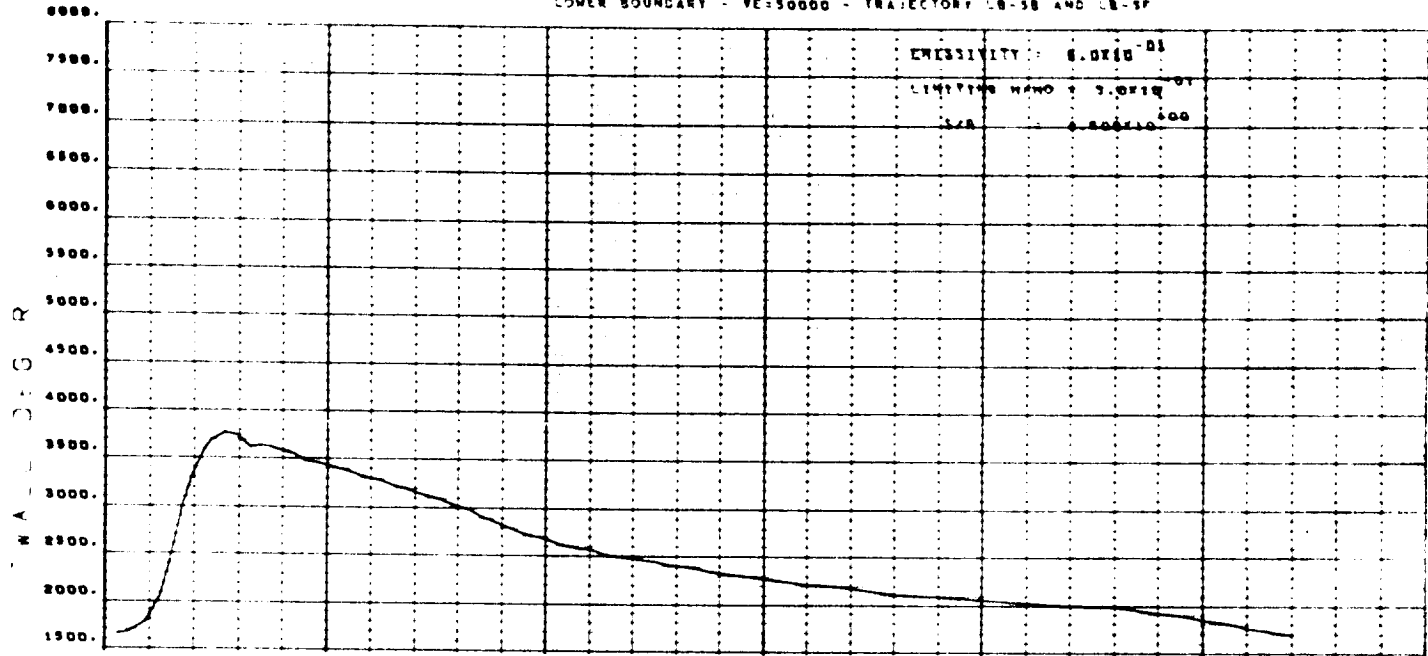


FIGURE 319

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=50000 - TRAJECTORY - LB-38 AND LB-37

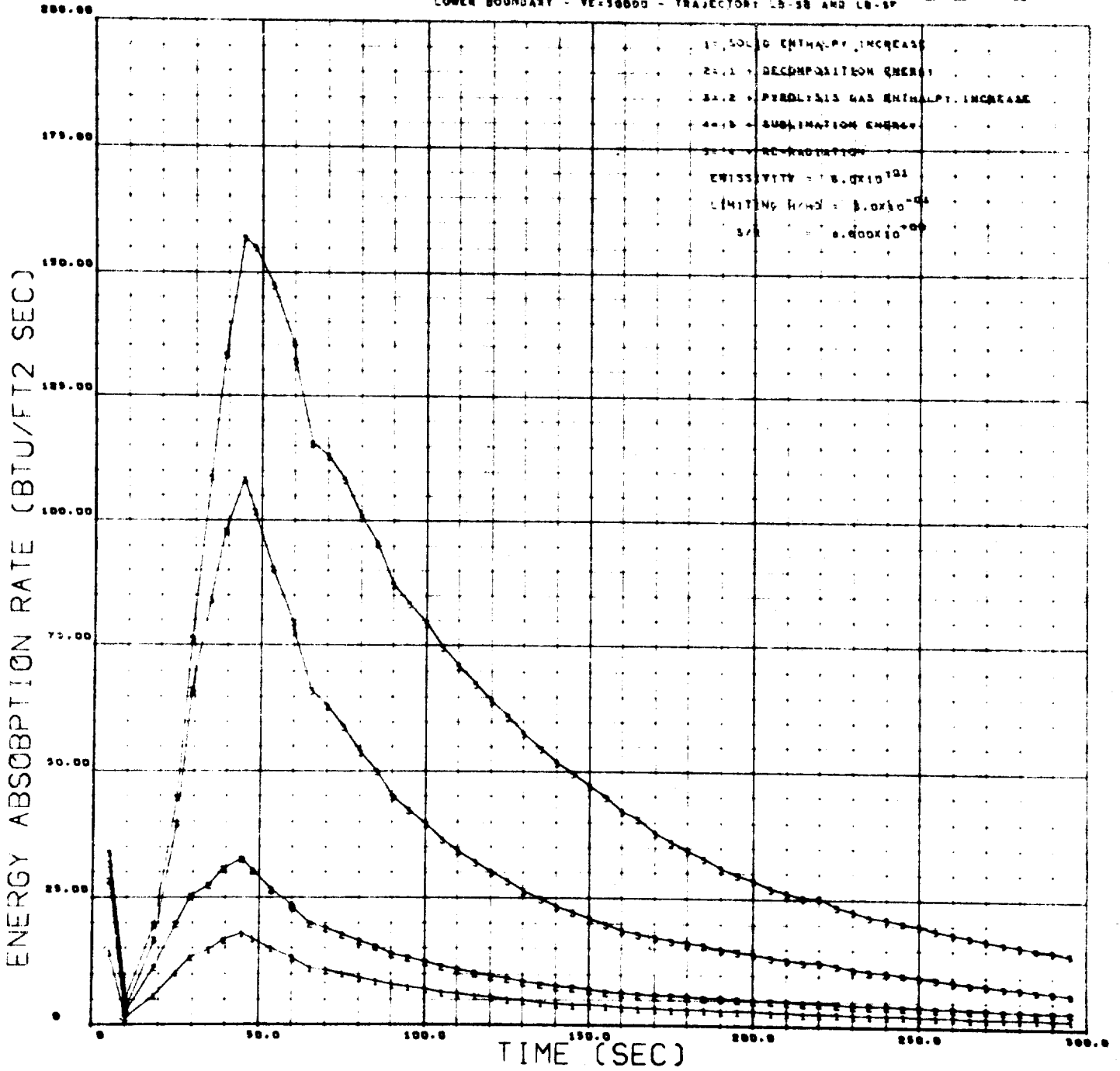


FIGURE B 20

HEATING RATE HISTORY

LOWER BOUNDARY - VE=50000 - TRAJECTORY LB-58 AND LB-57

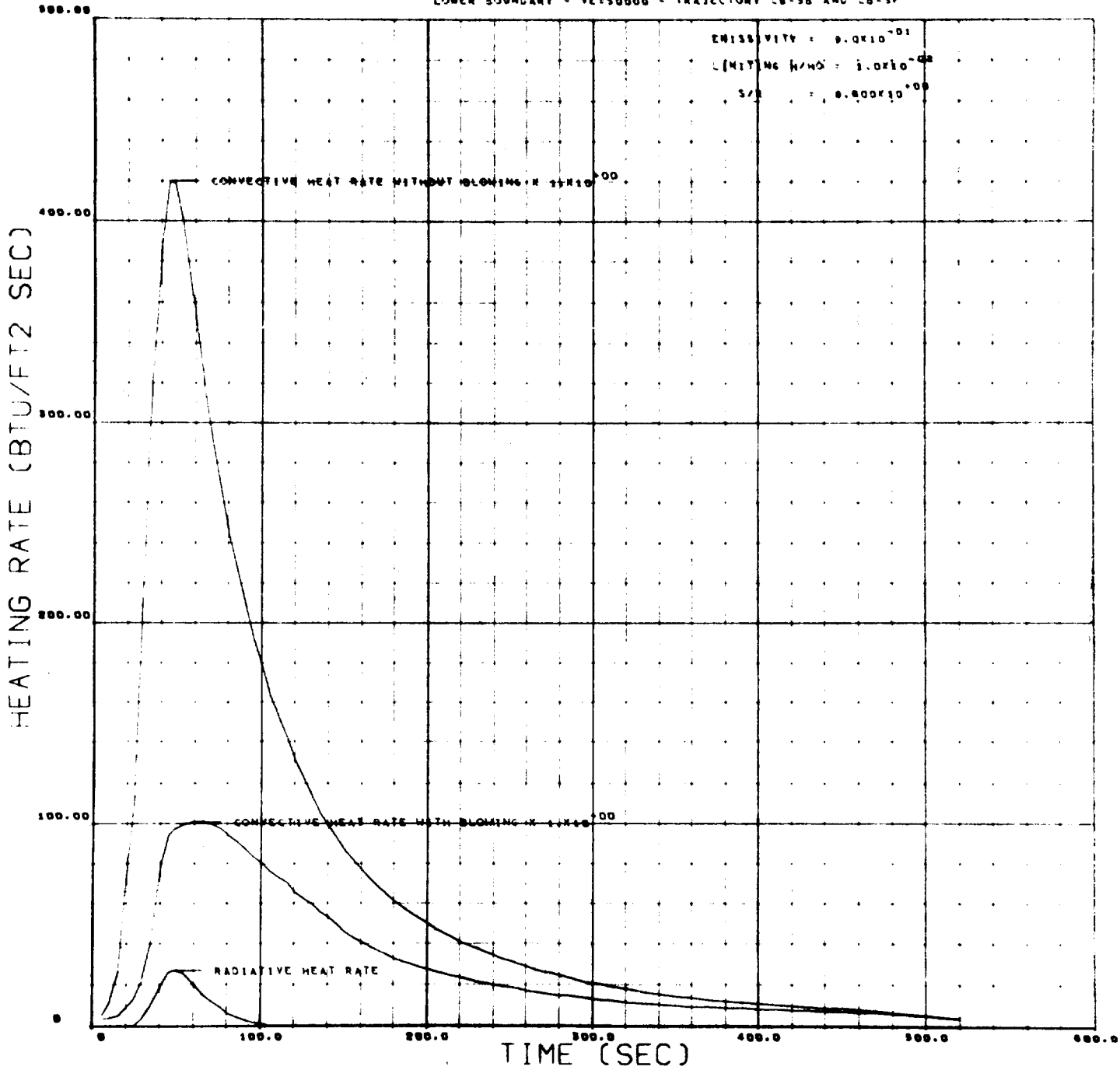


FIGURE B20

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VE=30000 - TRAJECTORY LB-38 AND LB-37

ENERGITY 3 8.0E10 - 01
LIMITING WENO 7 1.0E10 00
AIR 4 4.0E10 00

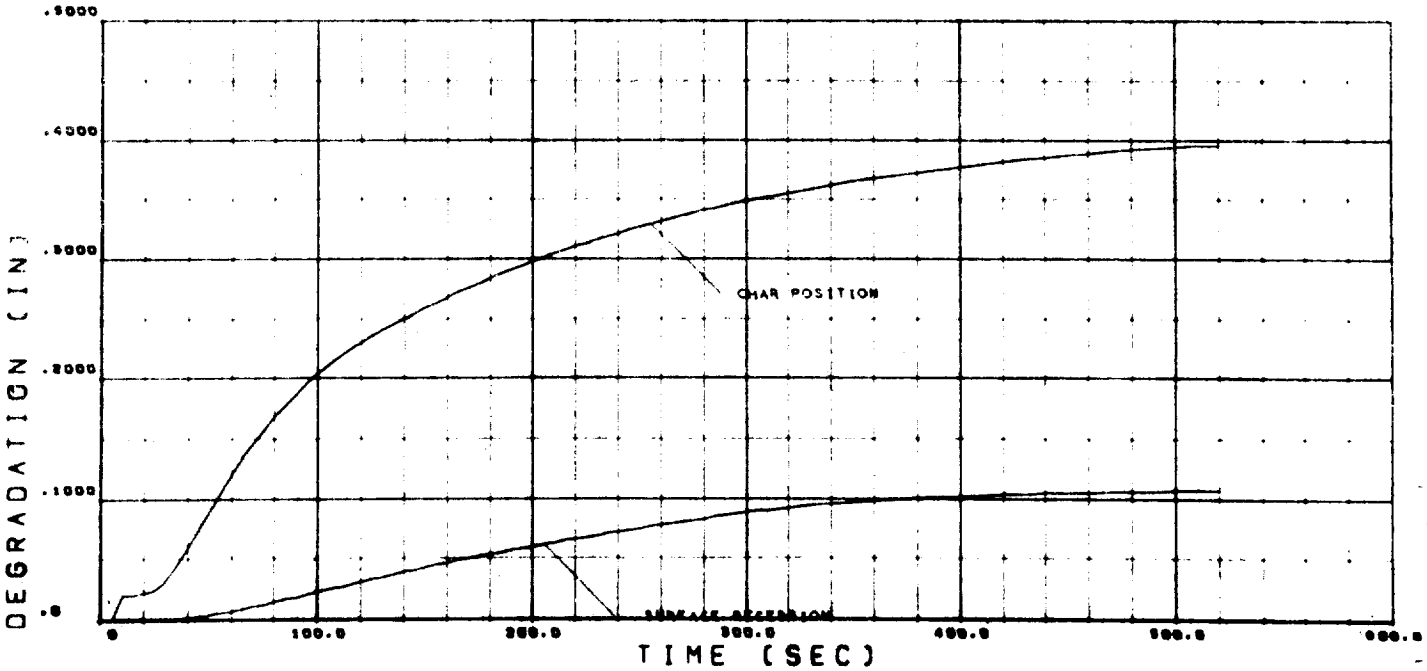
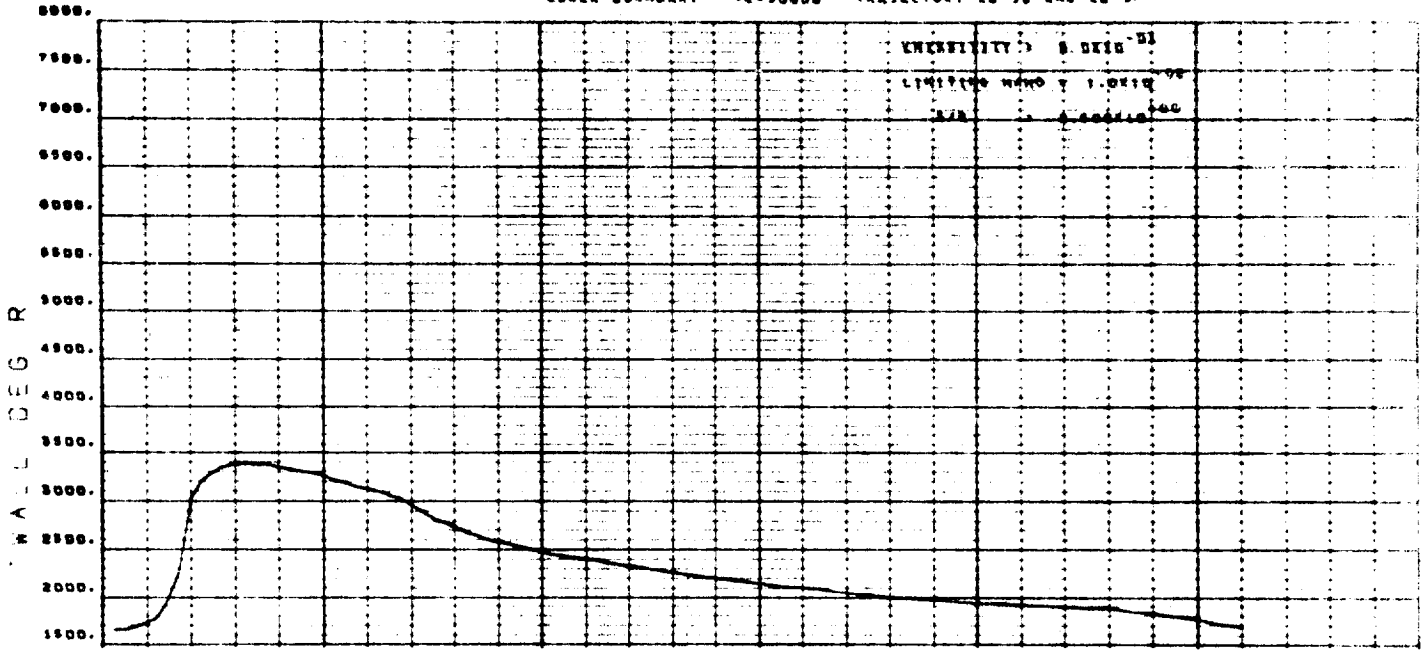


FIGURE B20

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=50000 - TRAJECTORY LB-56 AND LB-57

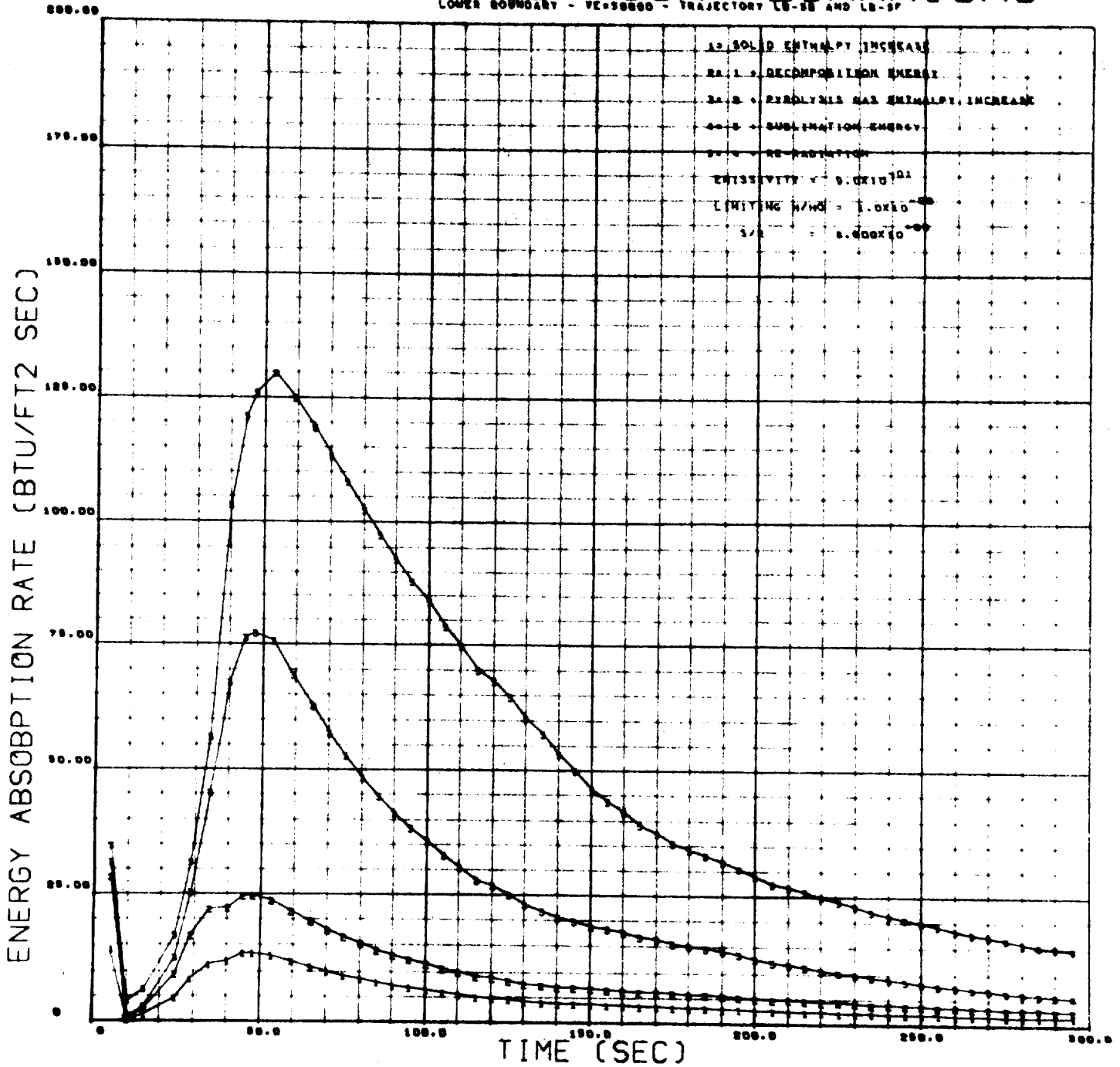


FIGURE 13.1

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=50000 - TRAJECTORY 13-18 AND 13-17

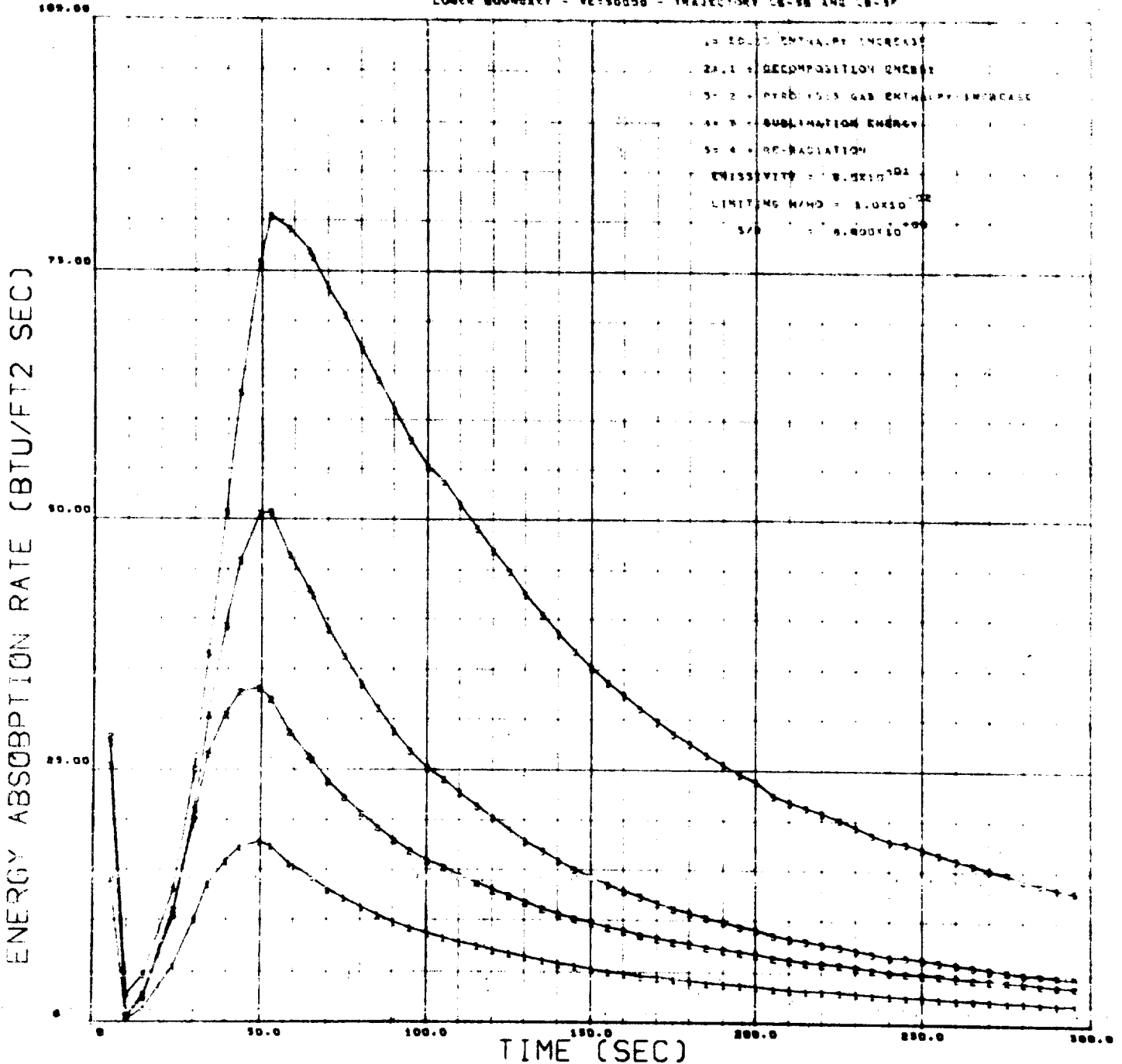


FIGURE B 21

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VE=50000 - TRAJECTORY LB-50 AND LB-51

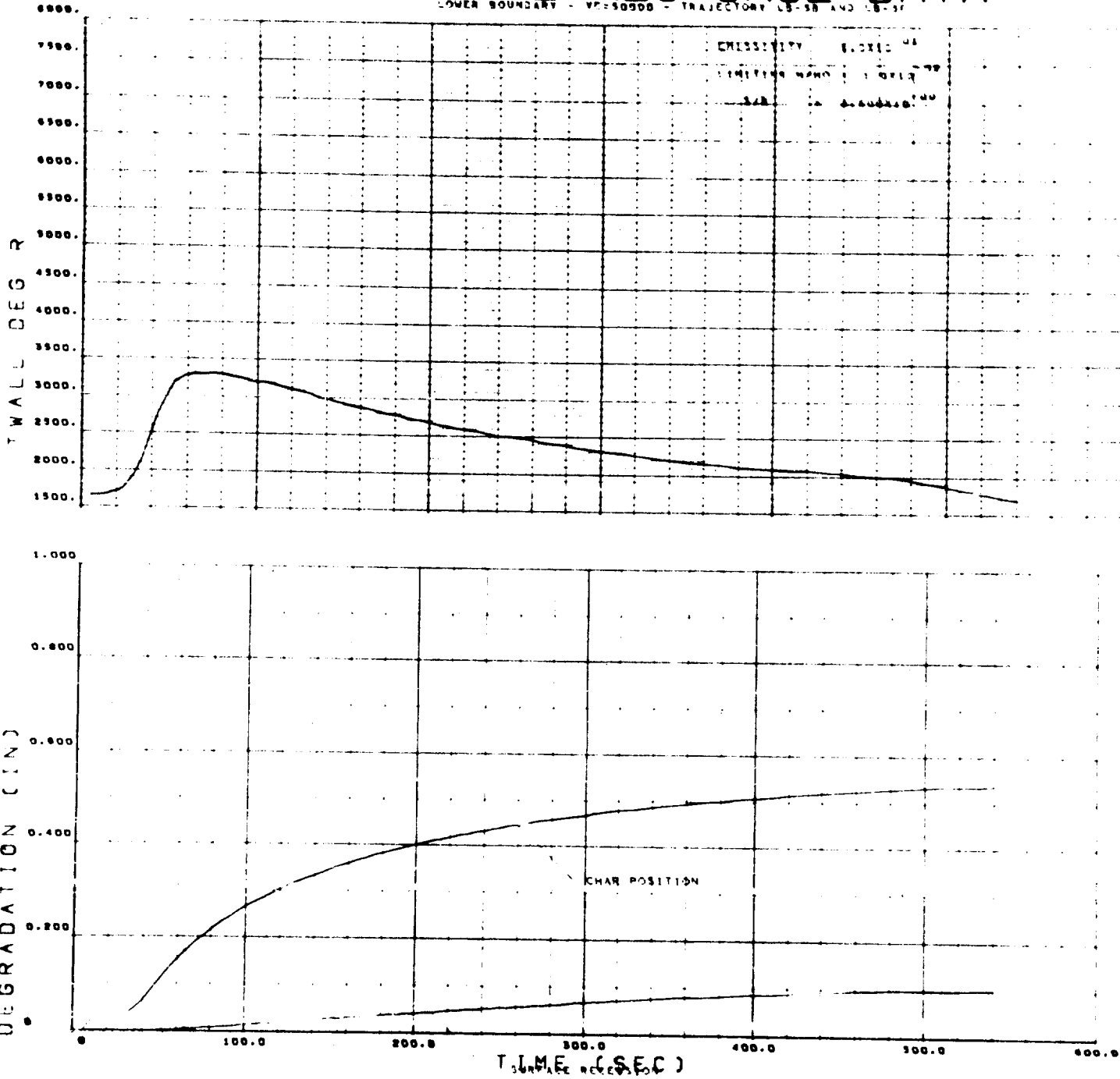


FIGURE 92

HEATING RATE HISTORY

LOWER BOUNDARY - VE=30000 - TRAJECTORY 25.10 AND 13.17

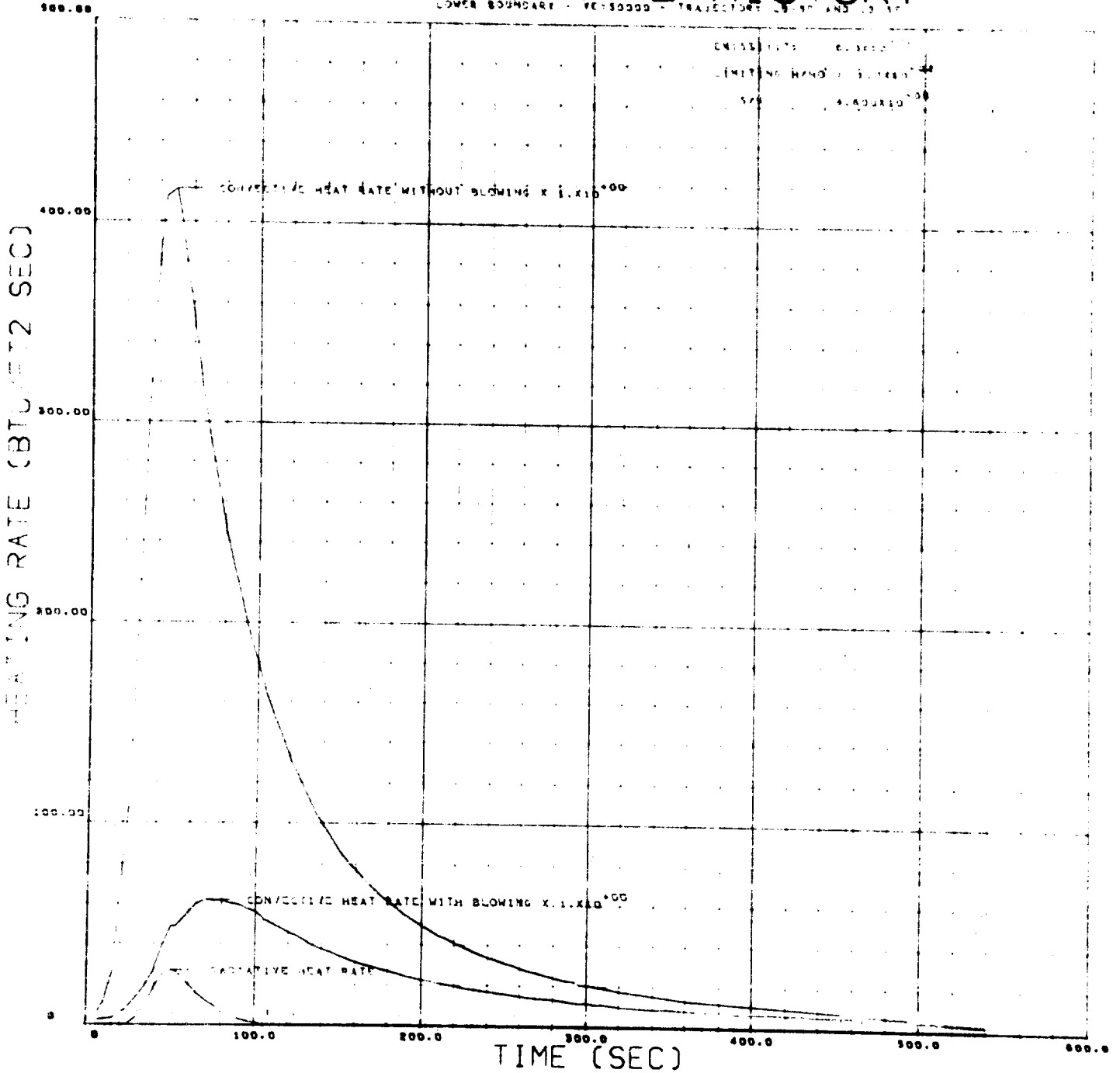


FIGURE B22

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - 1E+50000 - TRAJECTORY LB-45 AND 2-1F

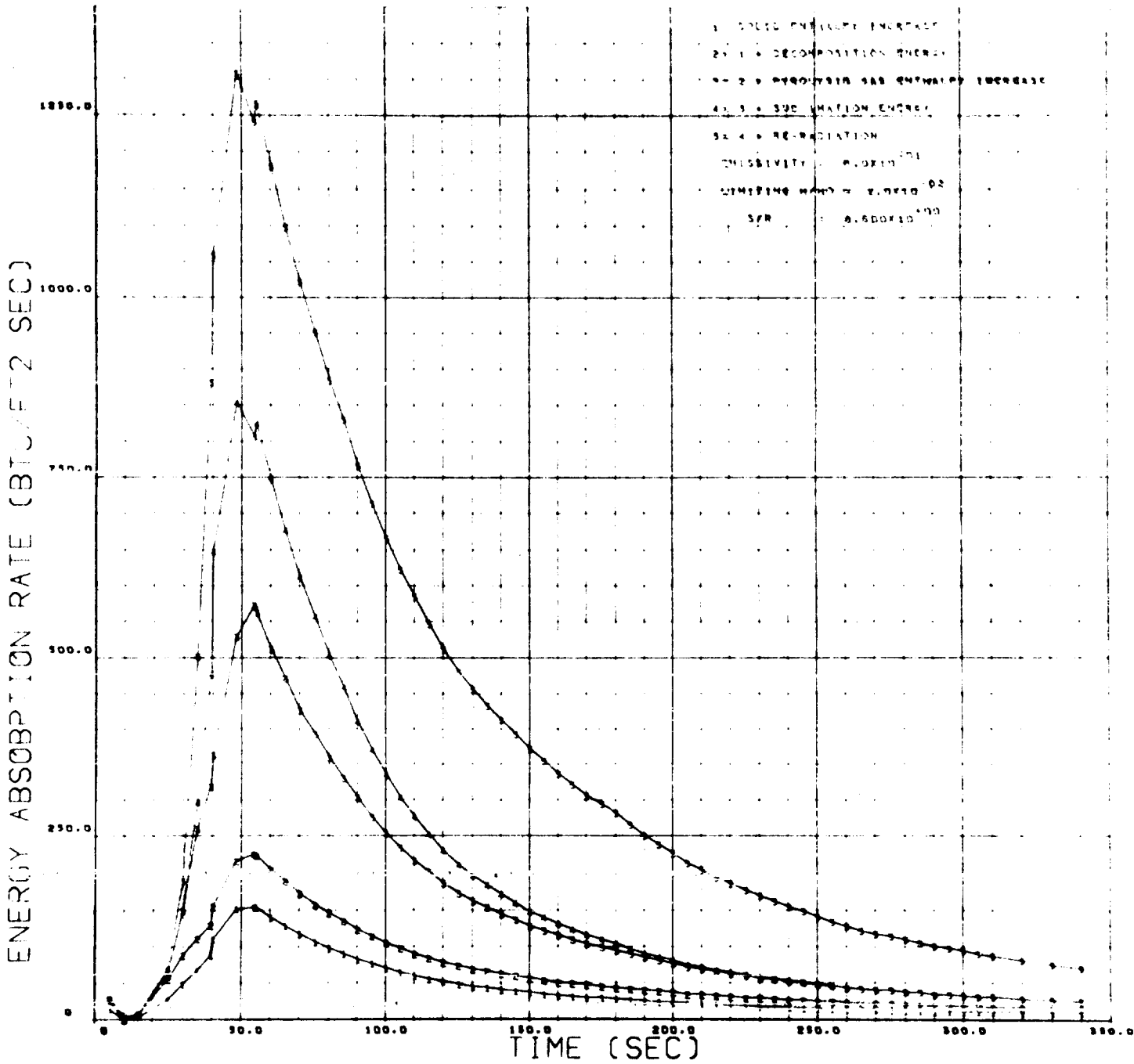


FIGURE B22

MATERIAL RESPONSE DATA

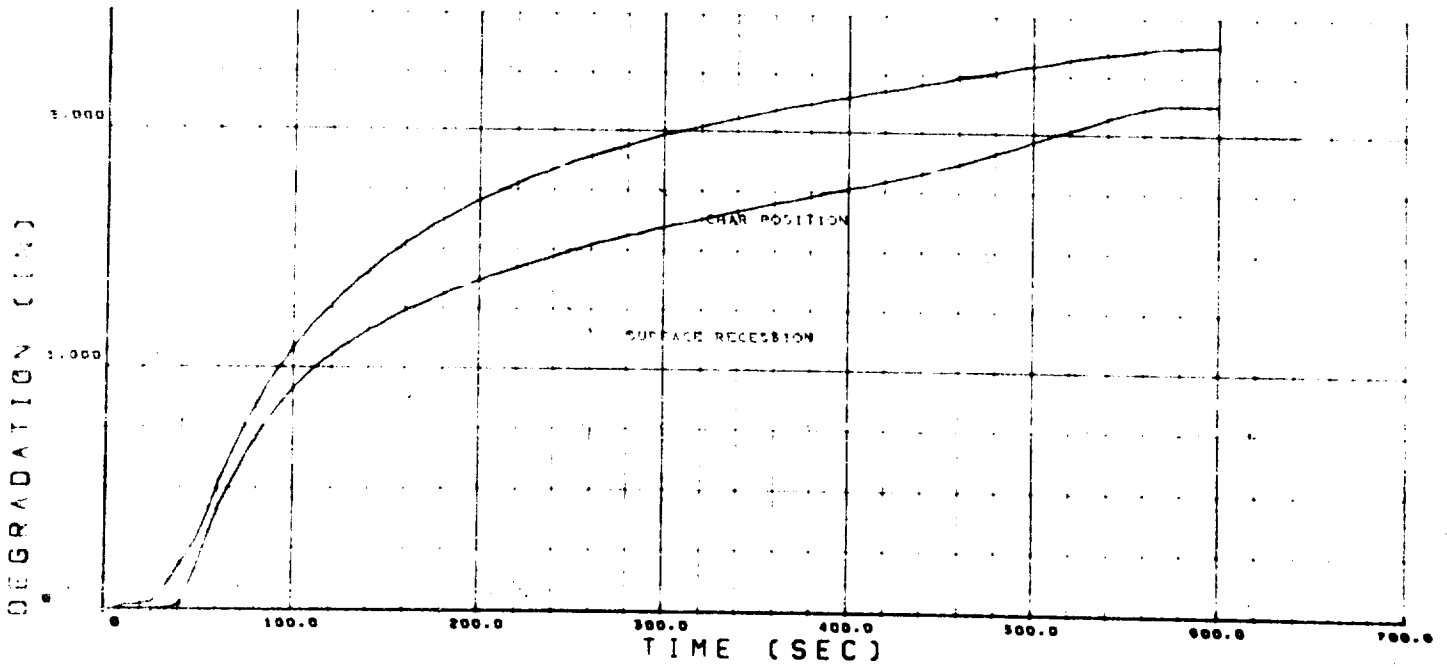
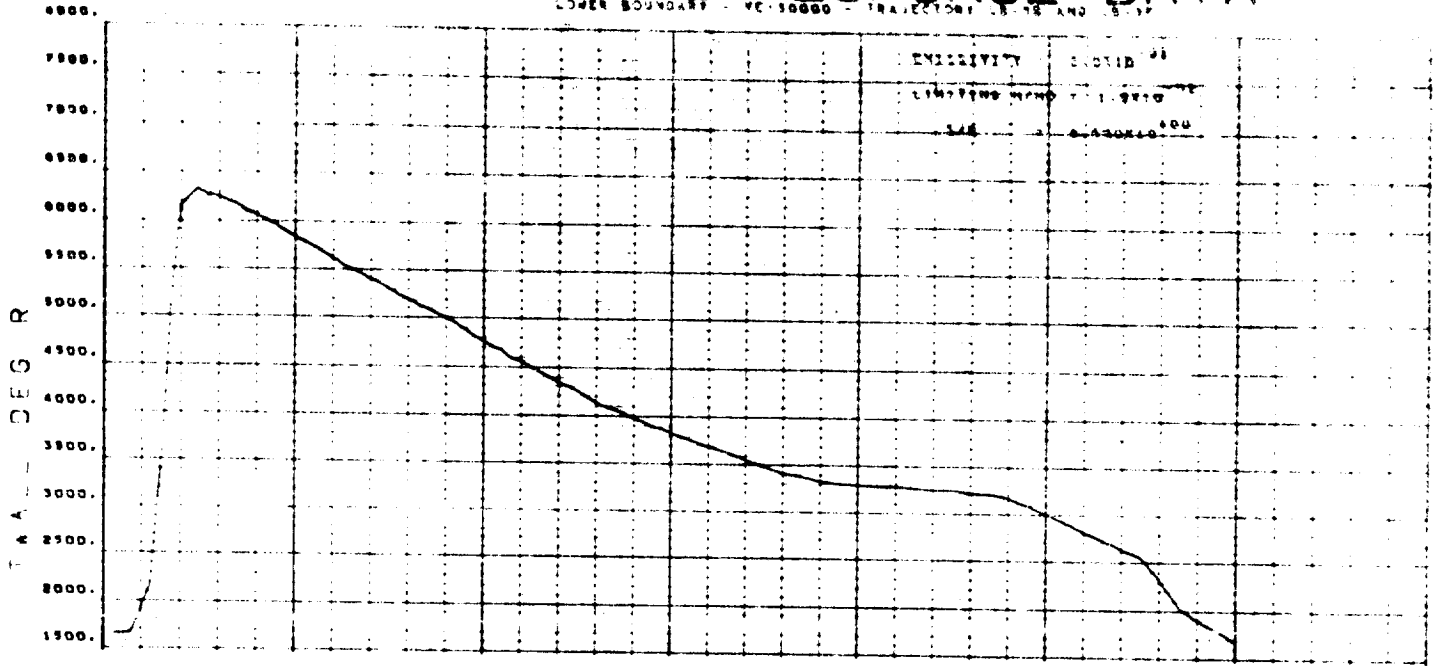


FIGURE B22

HEATING RATE HISTORY

LOWER BOUNDARY - Y=30000 - TRAJECTORY 0-10 AND 0-50

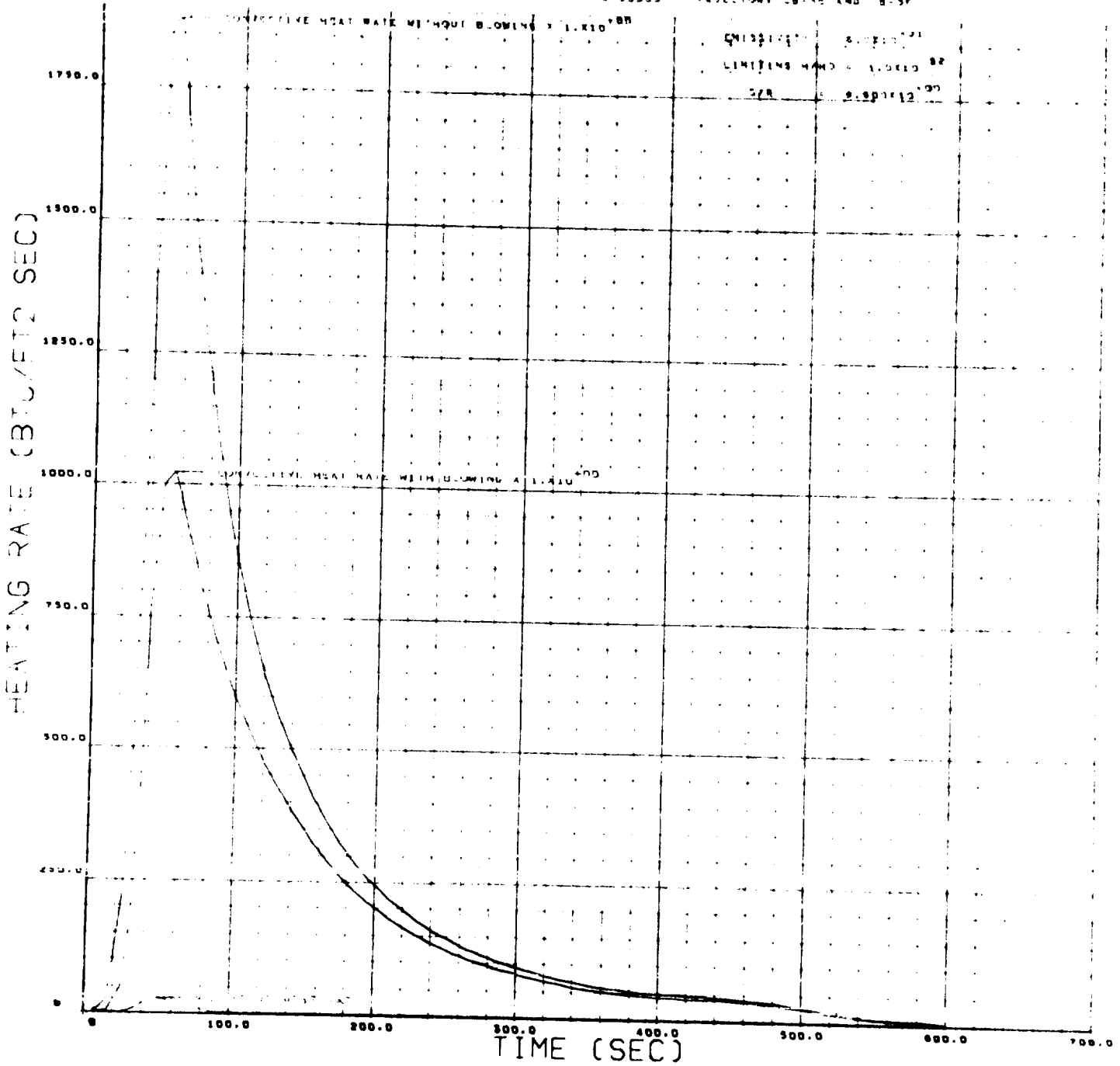


FIGURE B 23

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=57000 - TRAJECTORY 10-85 AND 10-87

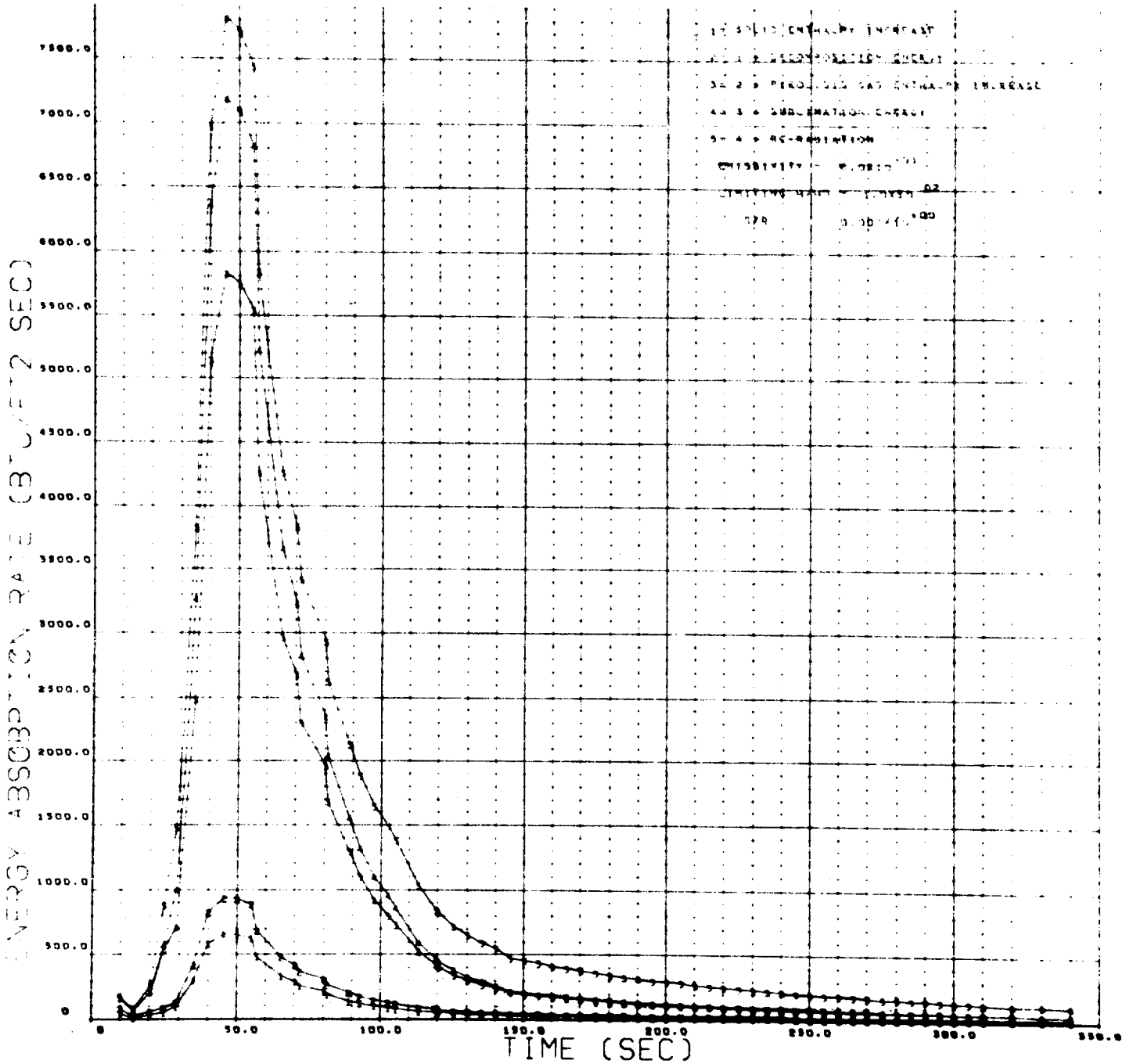


FIGURE B 23

MATERIAL RESPONSE DATA

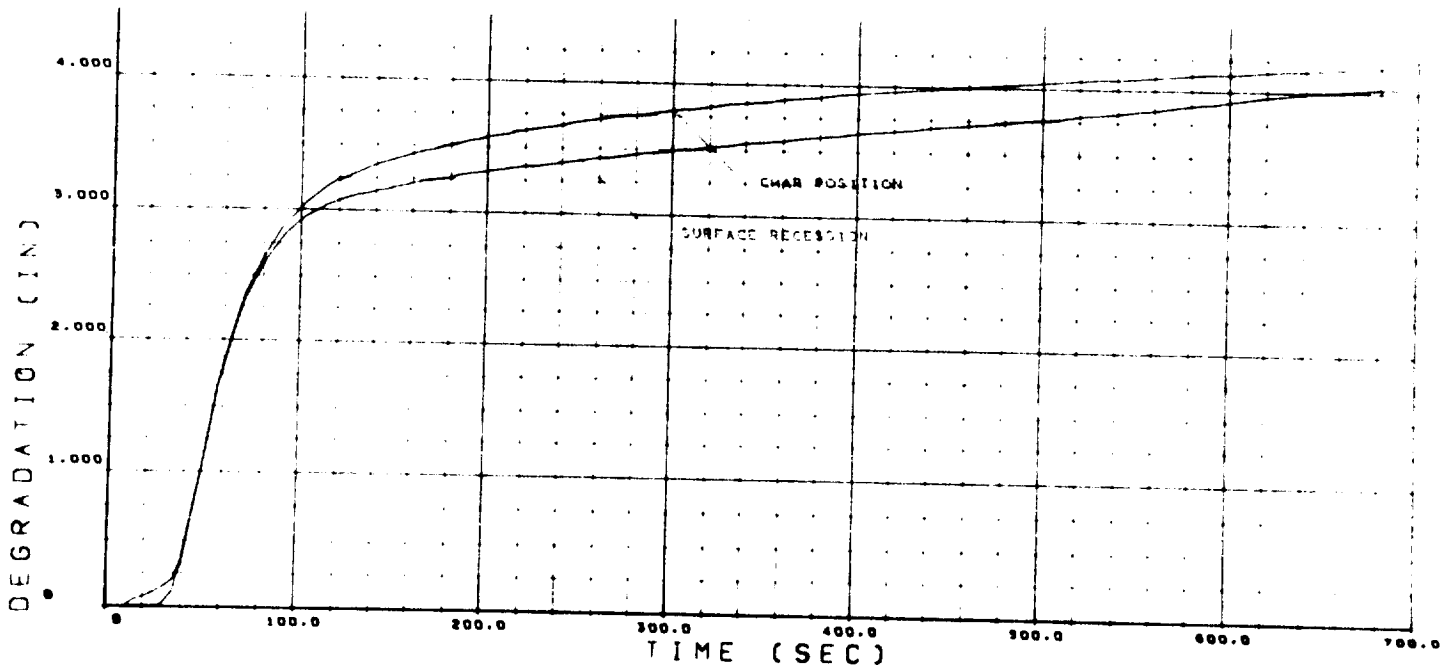
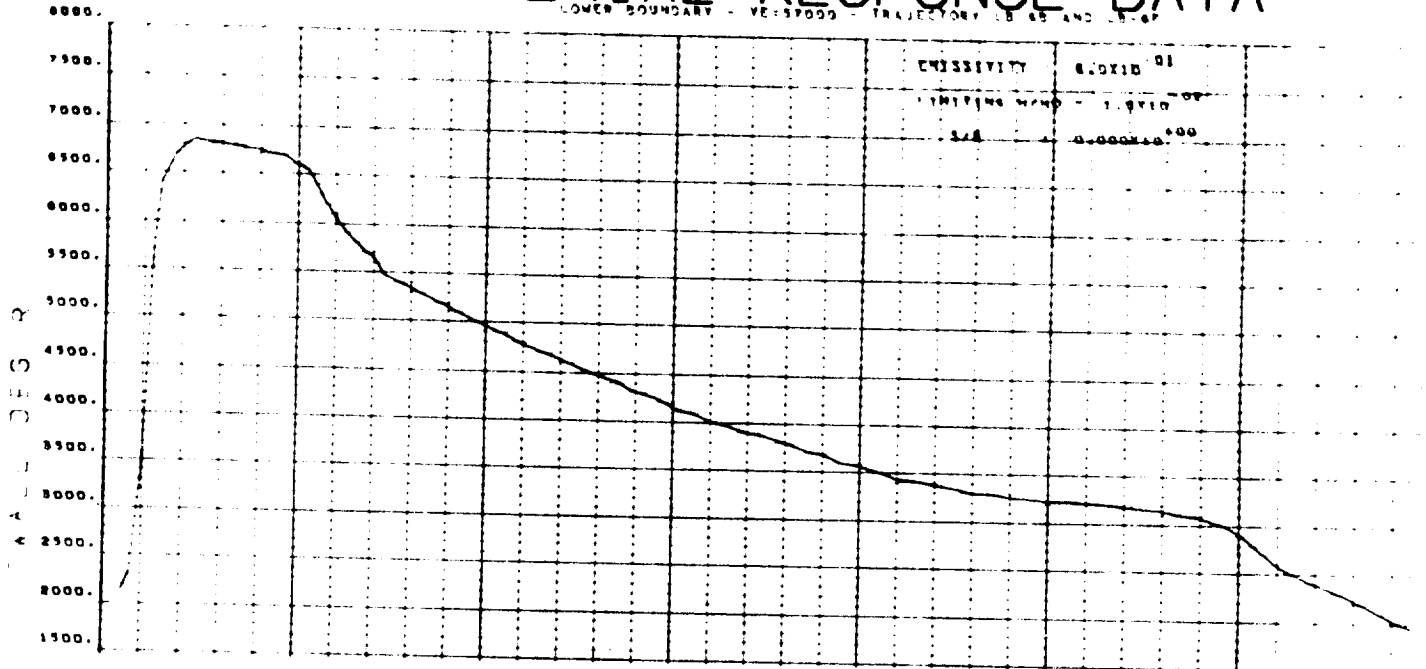


FIGURE B23

HEATING RATE HISTORY

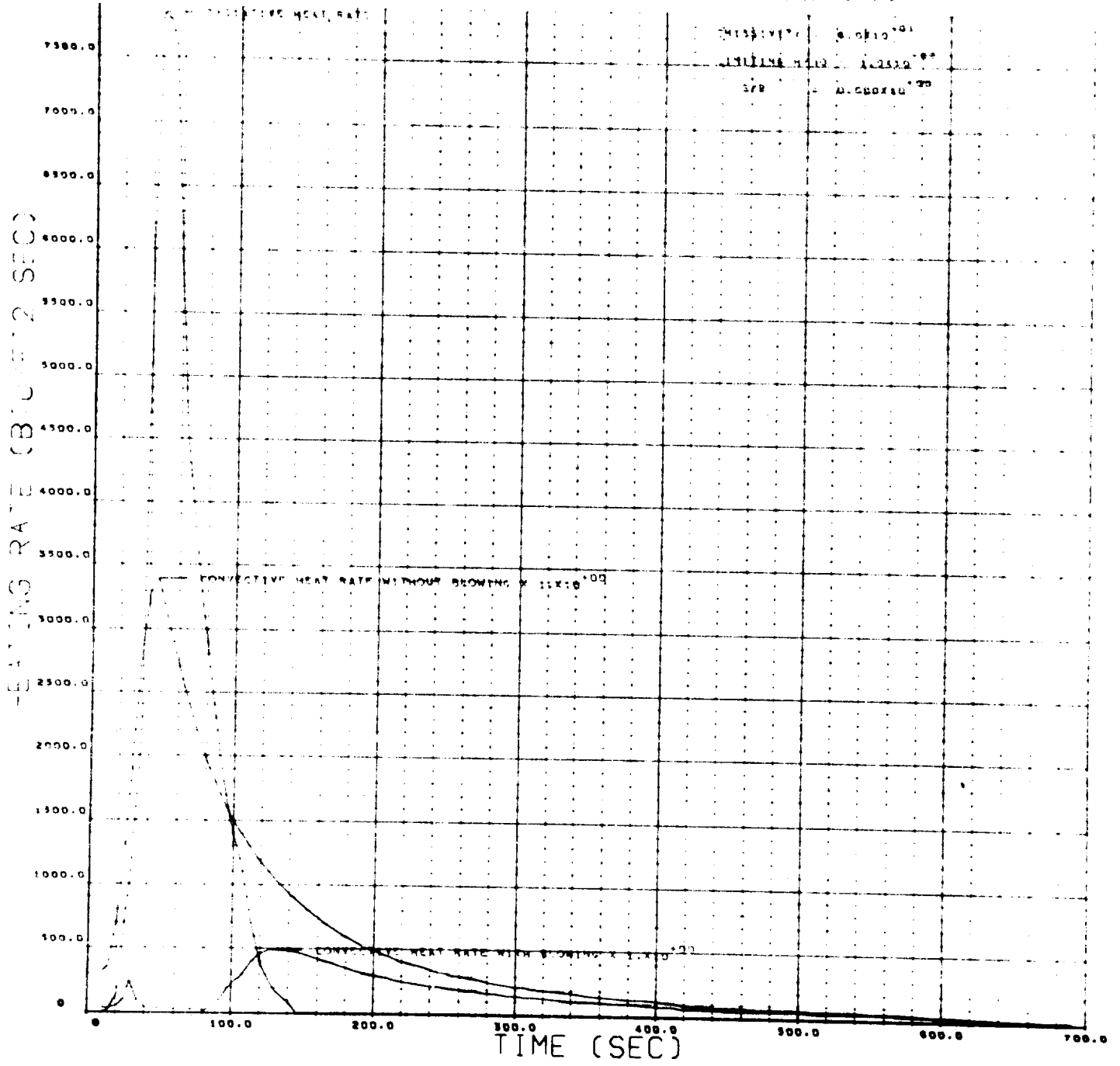


FIGURE B 24

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=57500 - TRAJECTORY B-63 AND B-67

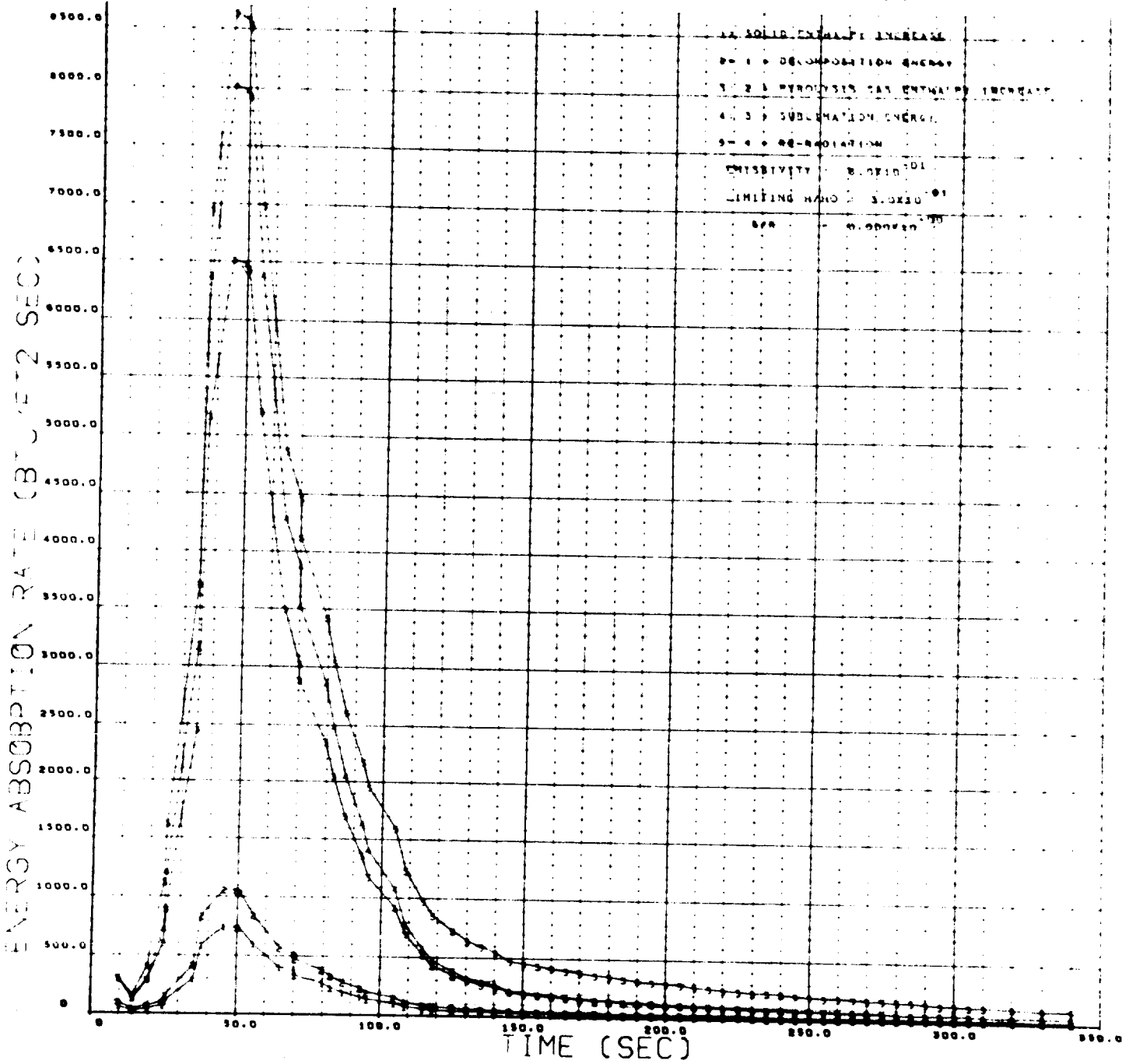


FIGURE B24

MATERIAL RESPONSE DATA

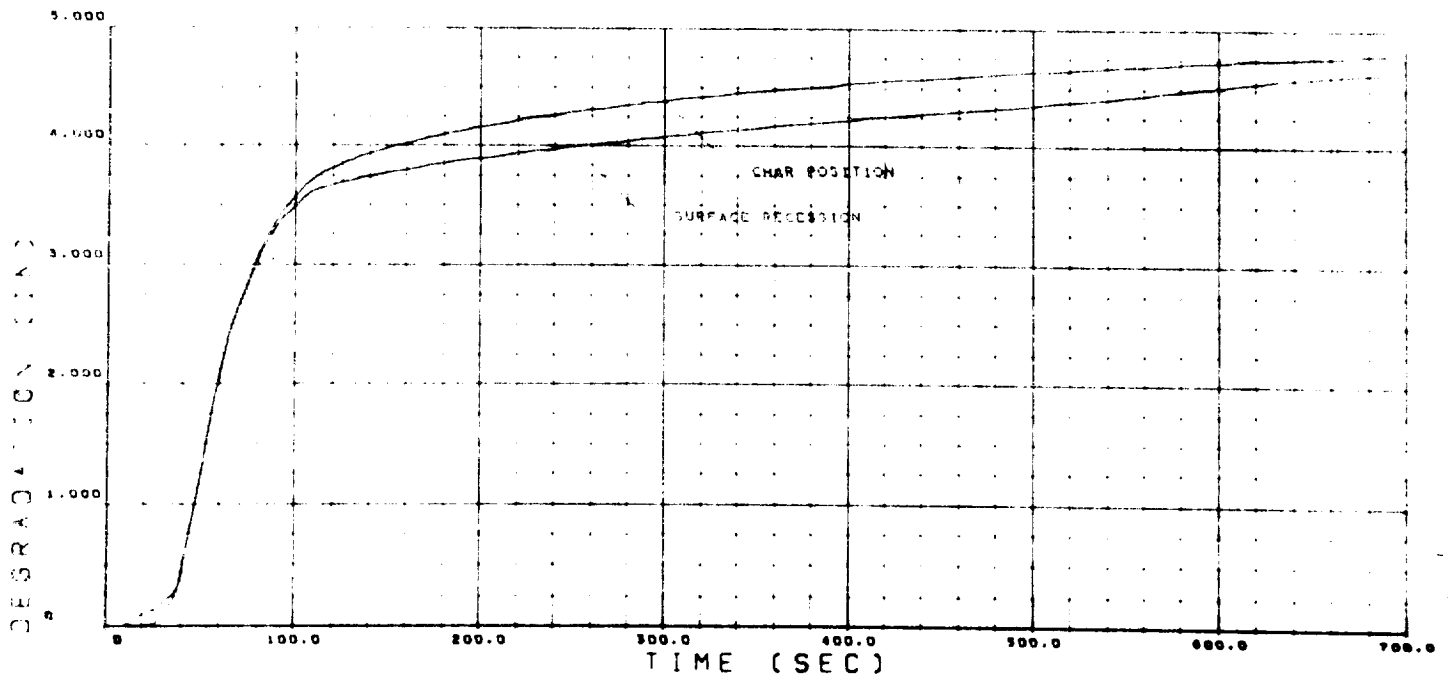
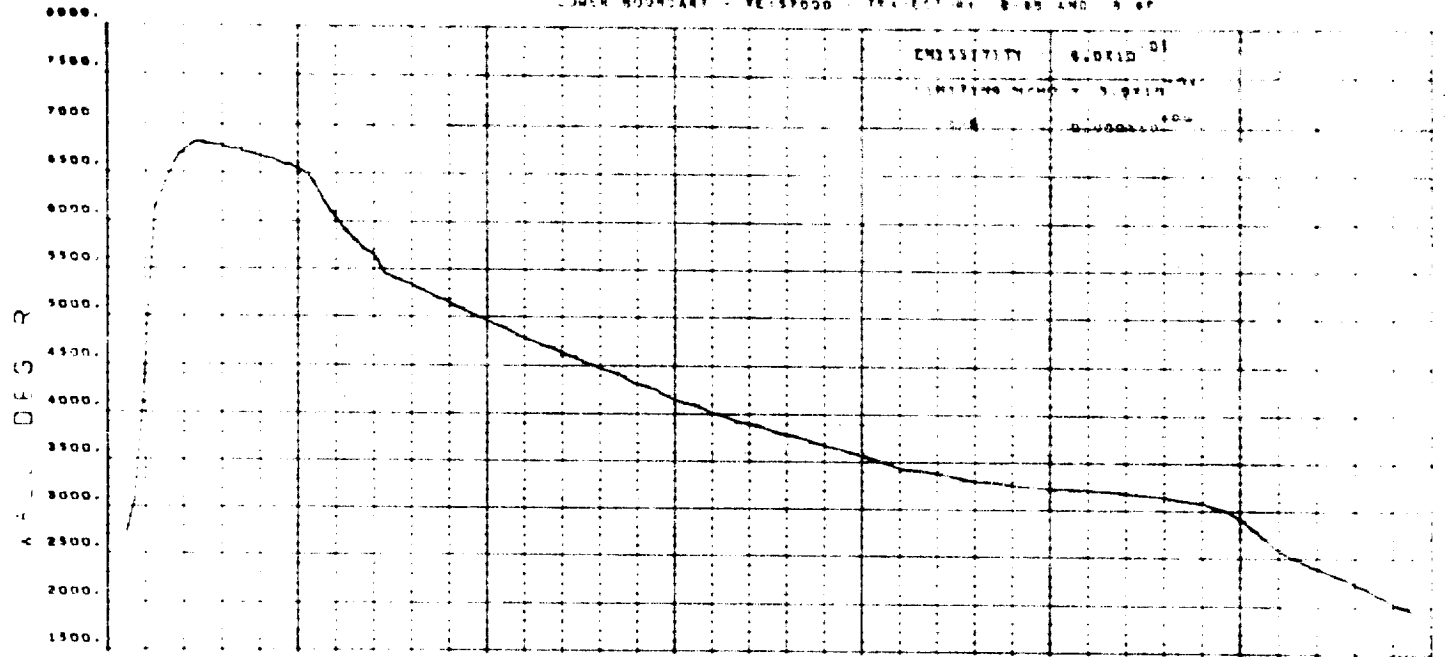


FIGURE B25

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VC-17000 TRAJECTORY - E-68 AND A-67

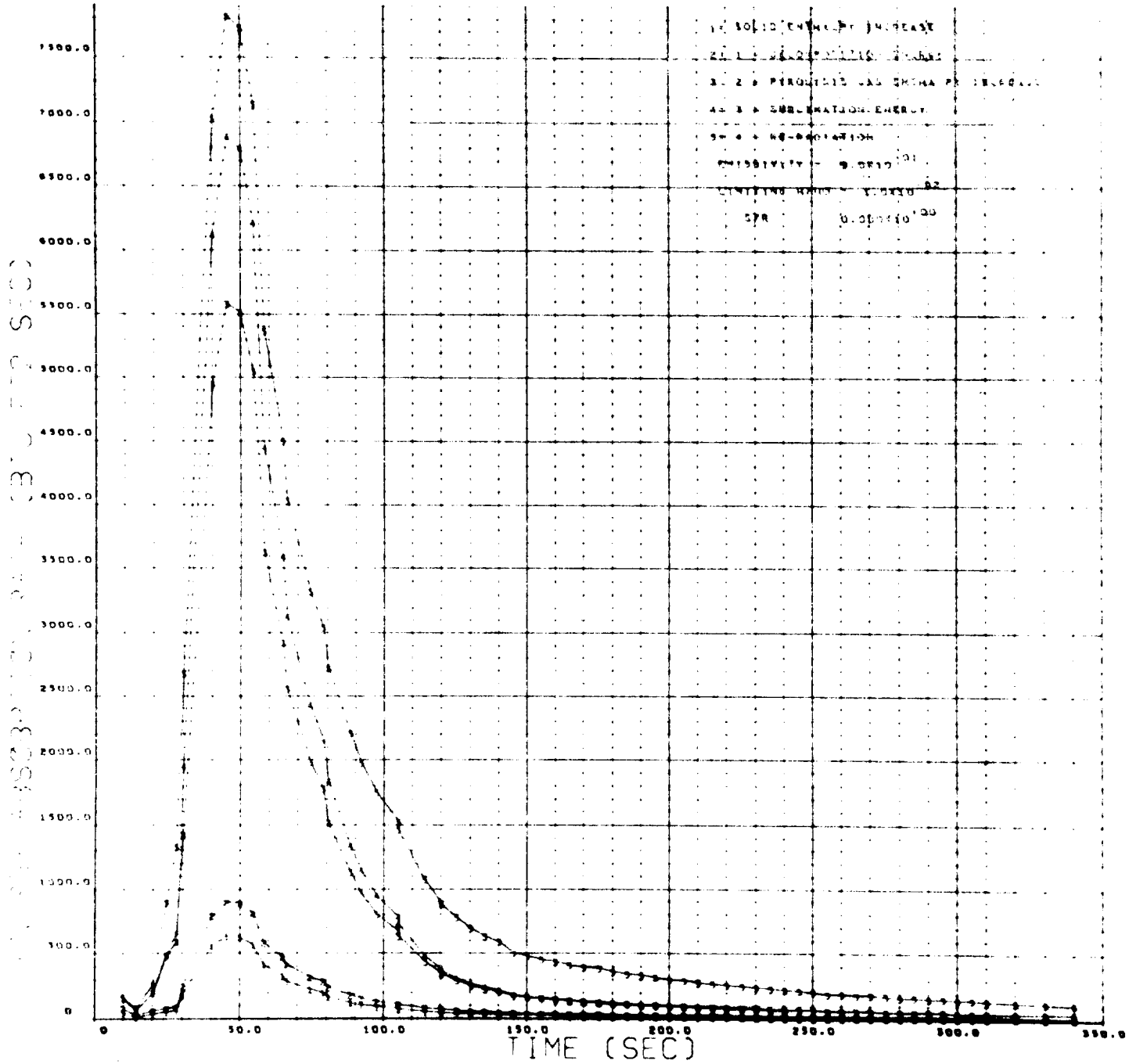


FIGURE B25

MATERIAL RESPONSE DATA

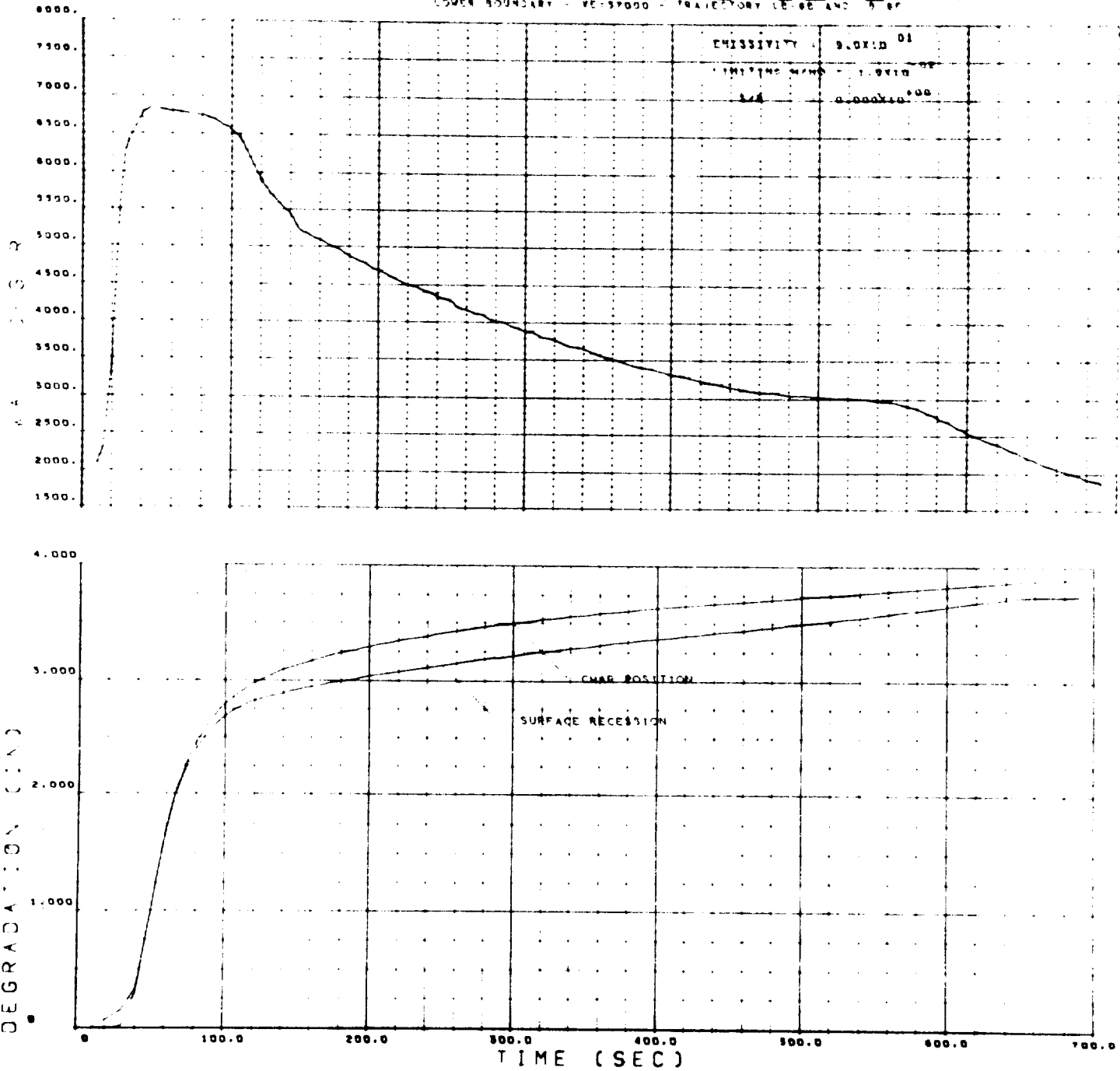
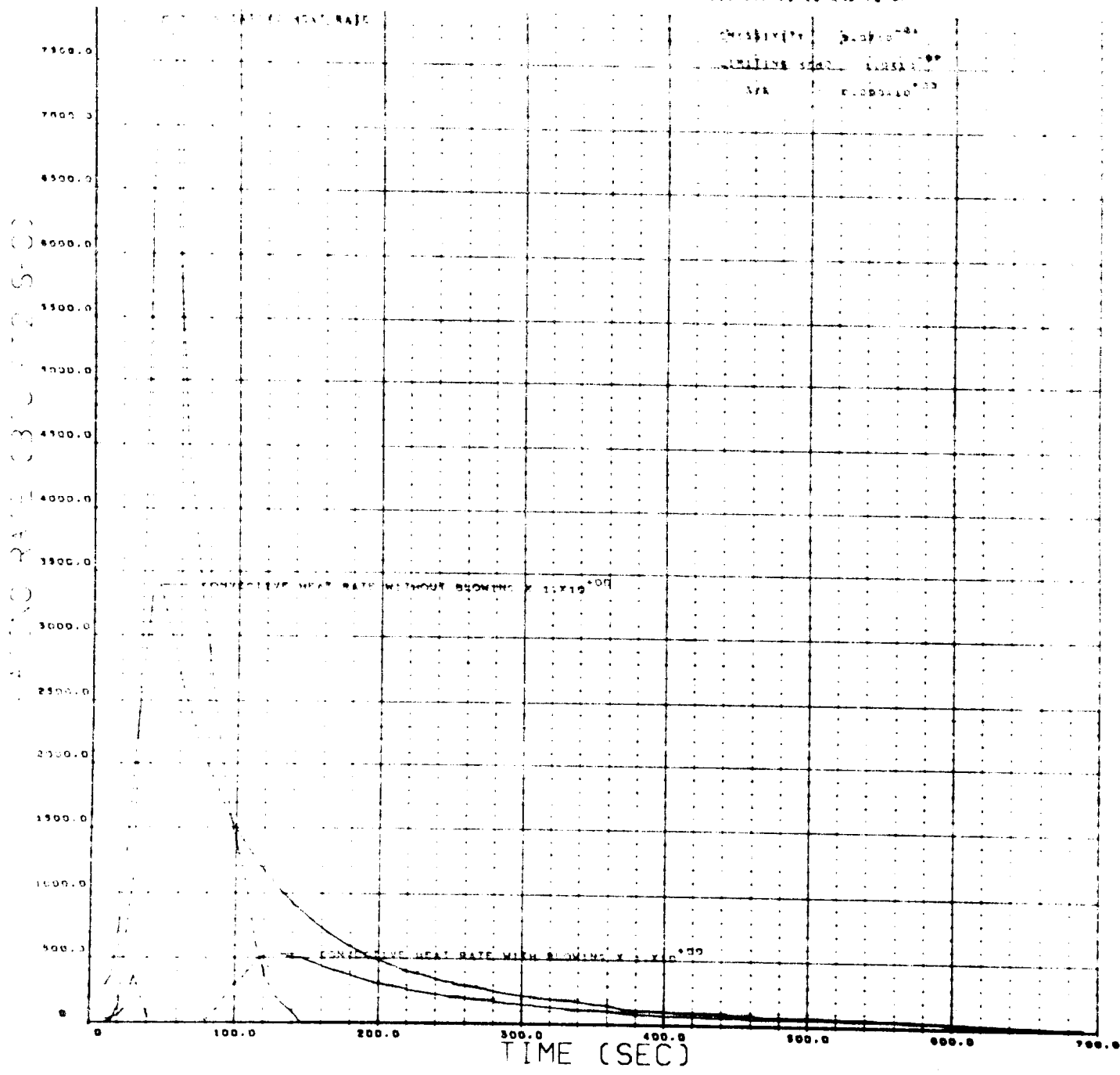


FIGURE B25

HEATING RATE HISTORY

LOWER TO INFLIGHT - HEAT RATE - TRAJECTORY 42.6 AND 48.67



42.6

FIGURE B26

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=57000 - TRAJECTORY LB-05 AND LB-07

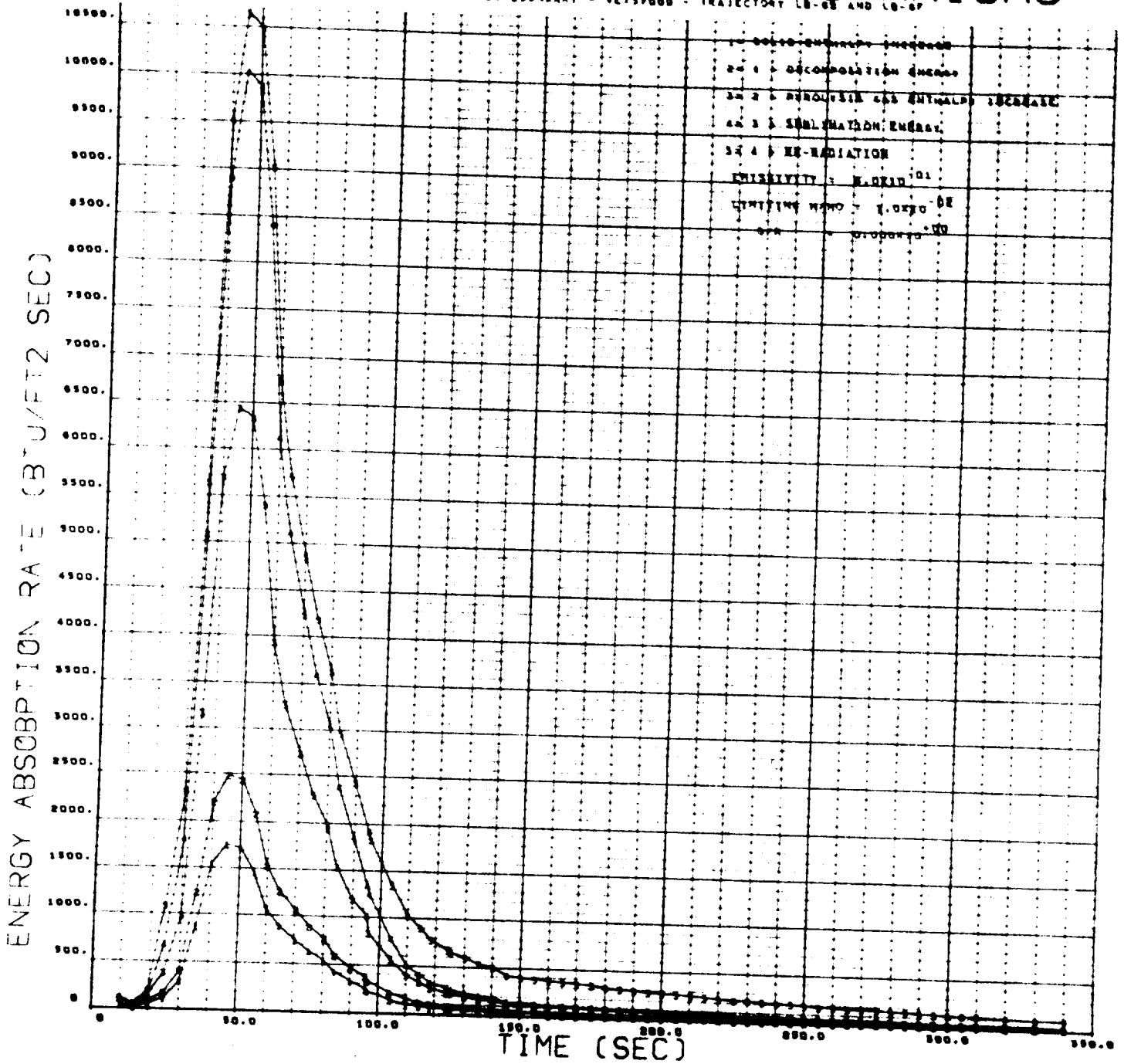
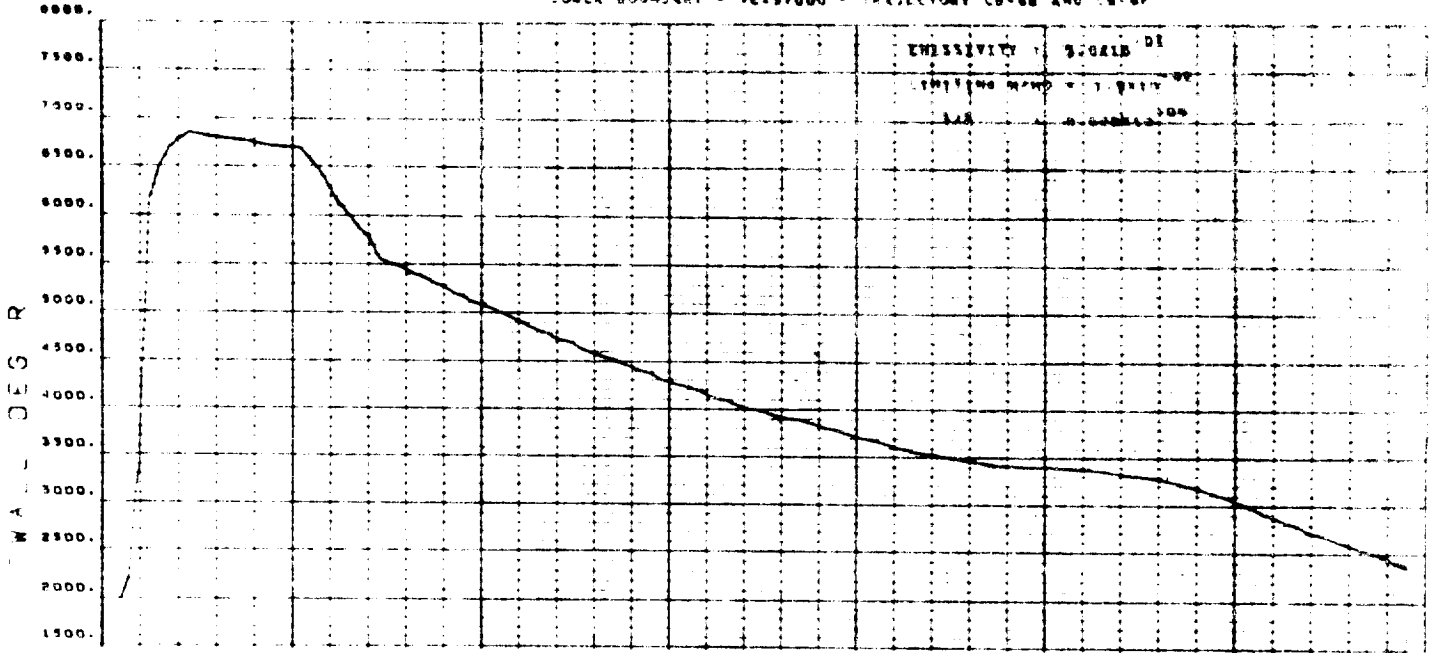


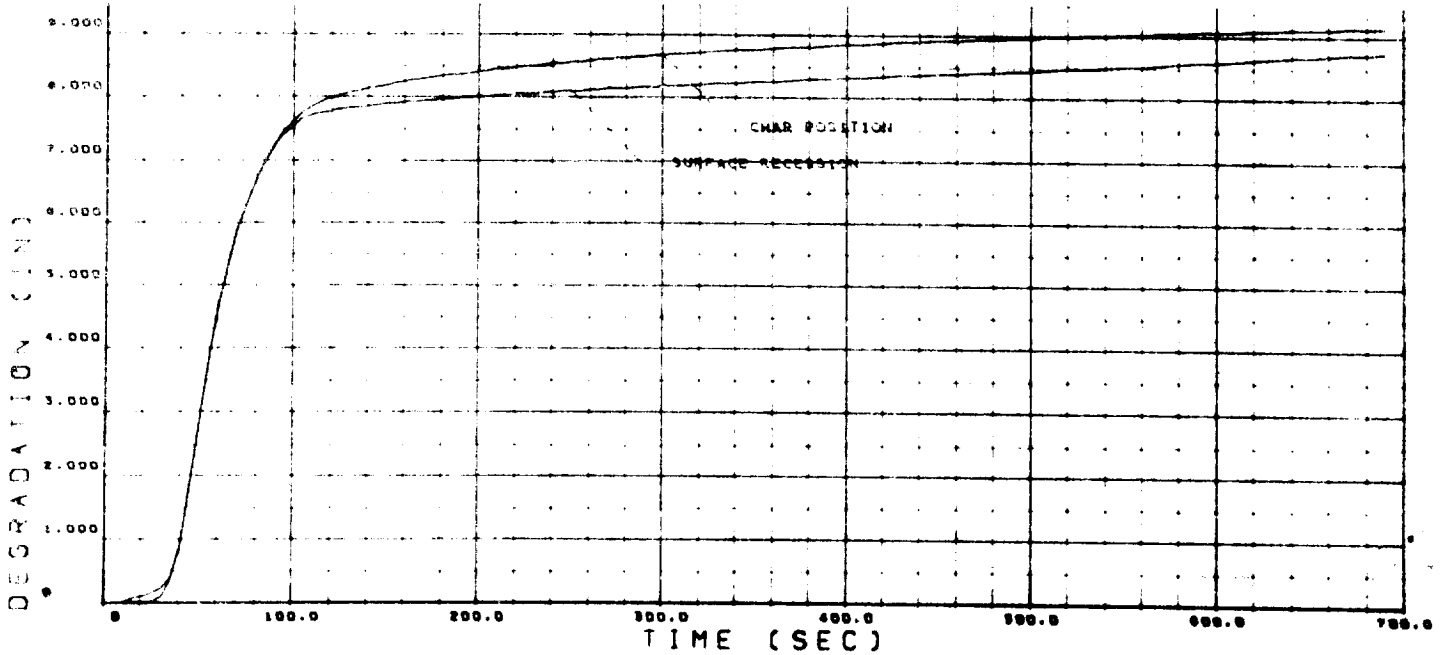
FIGURE B26

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VELOCITY - TRAJECTORY LB-08 AND 1-07



EMISSIVITY 0.90
INITIAL MASS 1.00
SURFACE REACTION

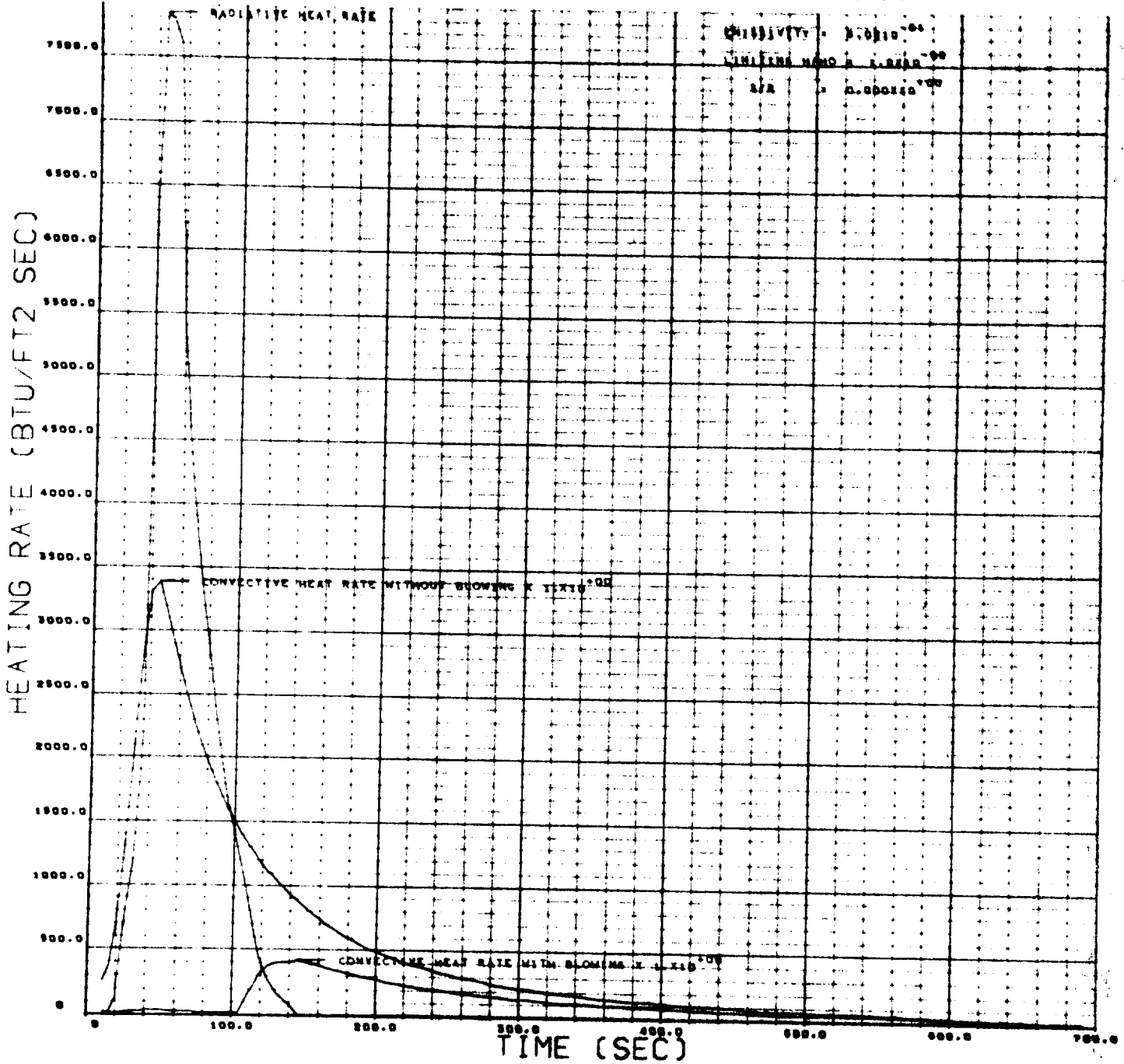


CHAR POSITION
SURFACE REACTION

FIGURE B26

HEATING RATE HISTORY

LOWER BOUNDARY - VE=37800 - TRAJECTORY LE-88 AND LE-87



MISSIVITY - 0.010
MINIMUM NO. - 1.000
S/A - 0.000

FIGURE B 27

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VE-17688 - TRAJECTORY LE-01 AND LE-07

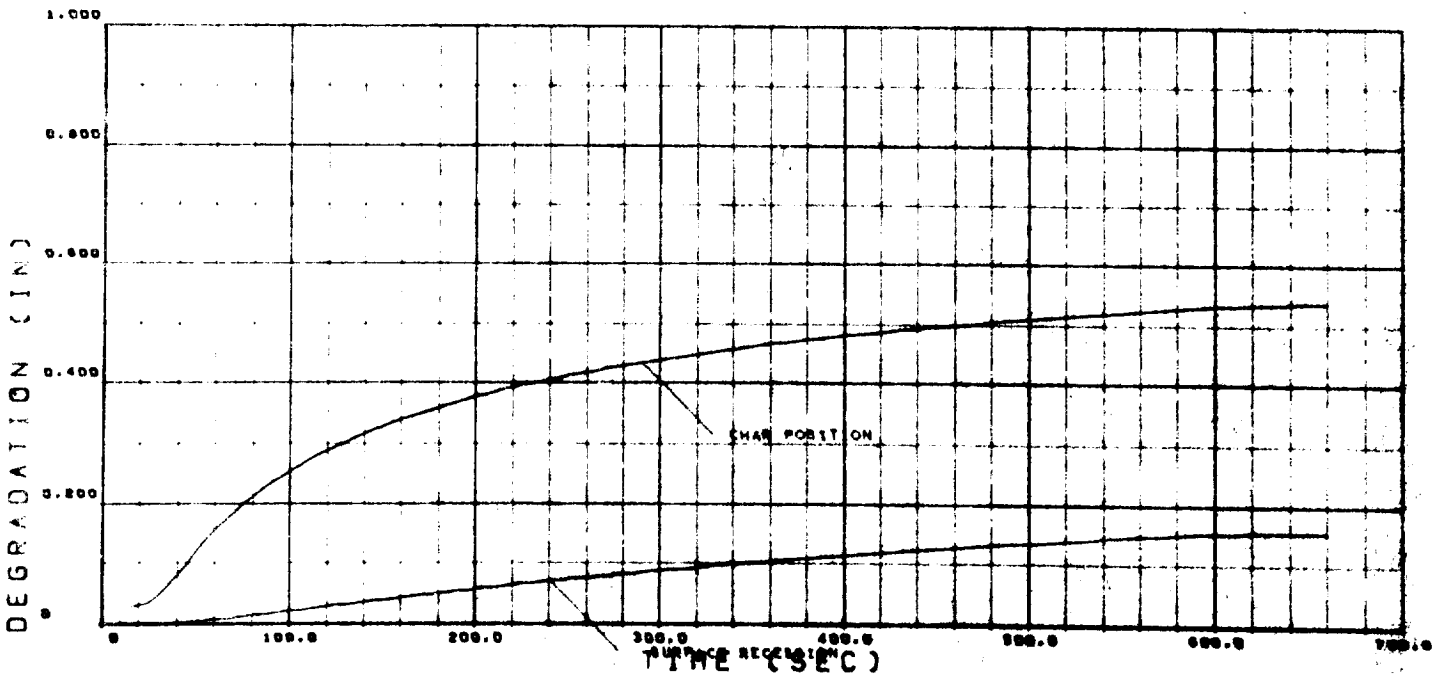
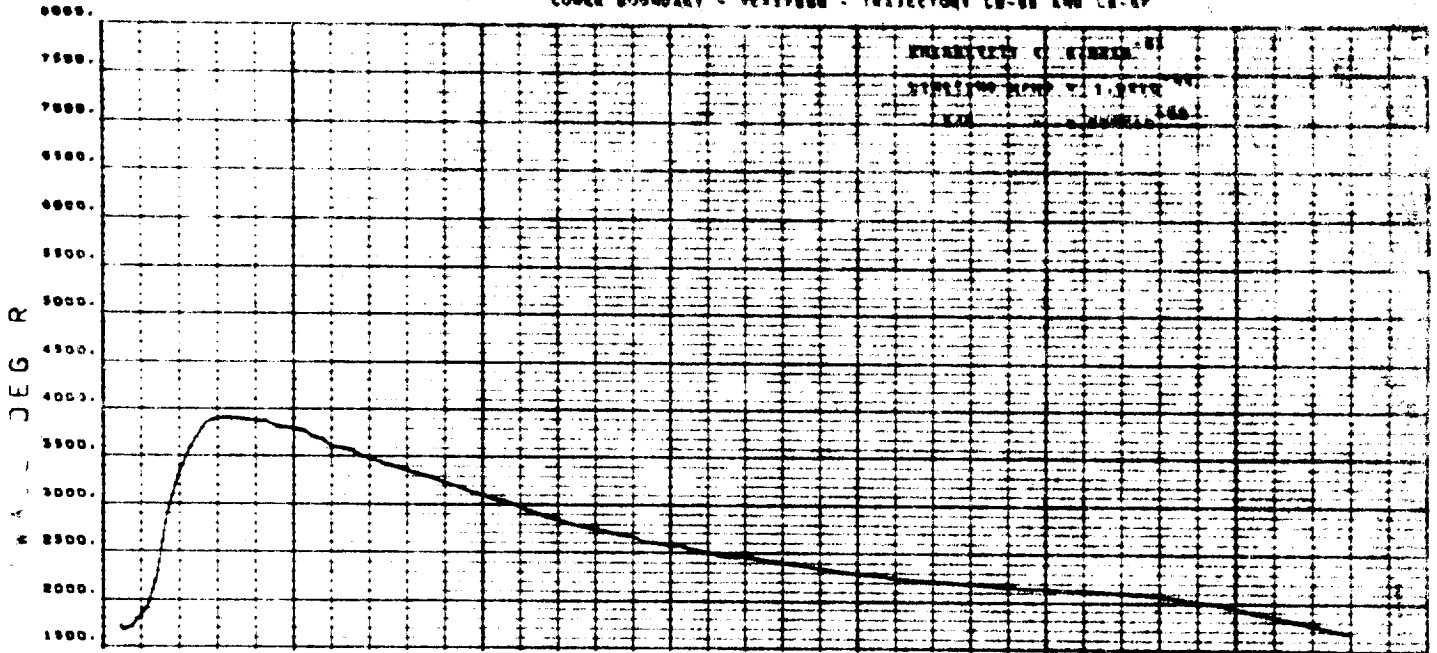


FIGURE B27

HEATING RATE HISTORY

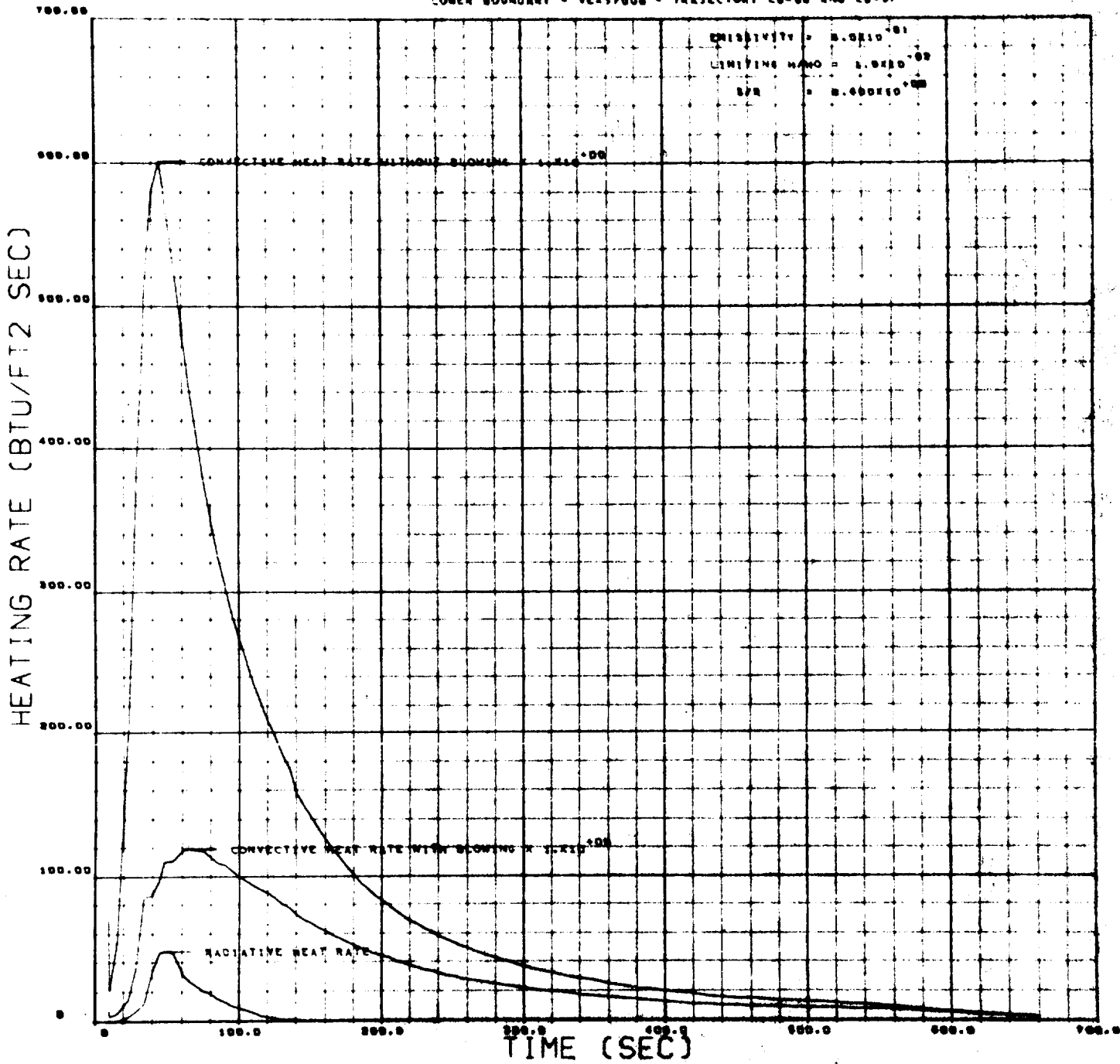


FIGURE B27

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=17500 - TRAJECTORY LG-98 AND LG-97

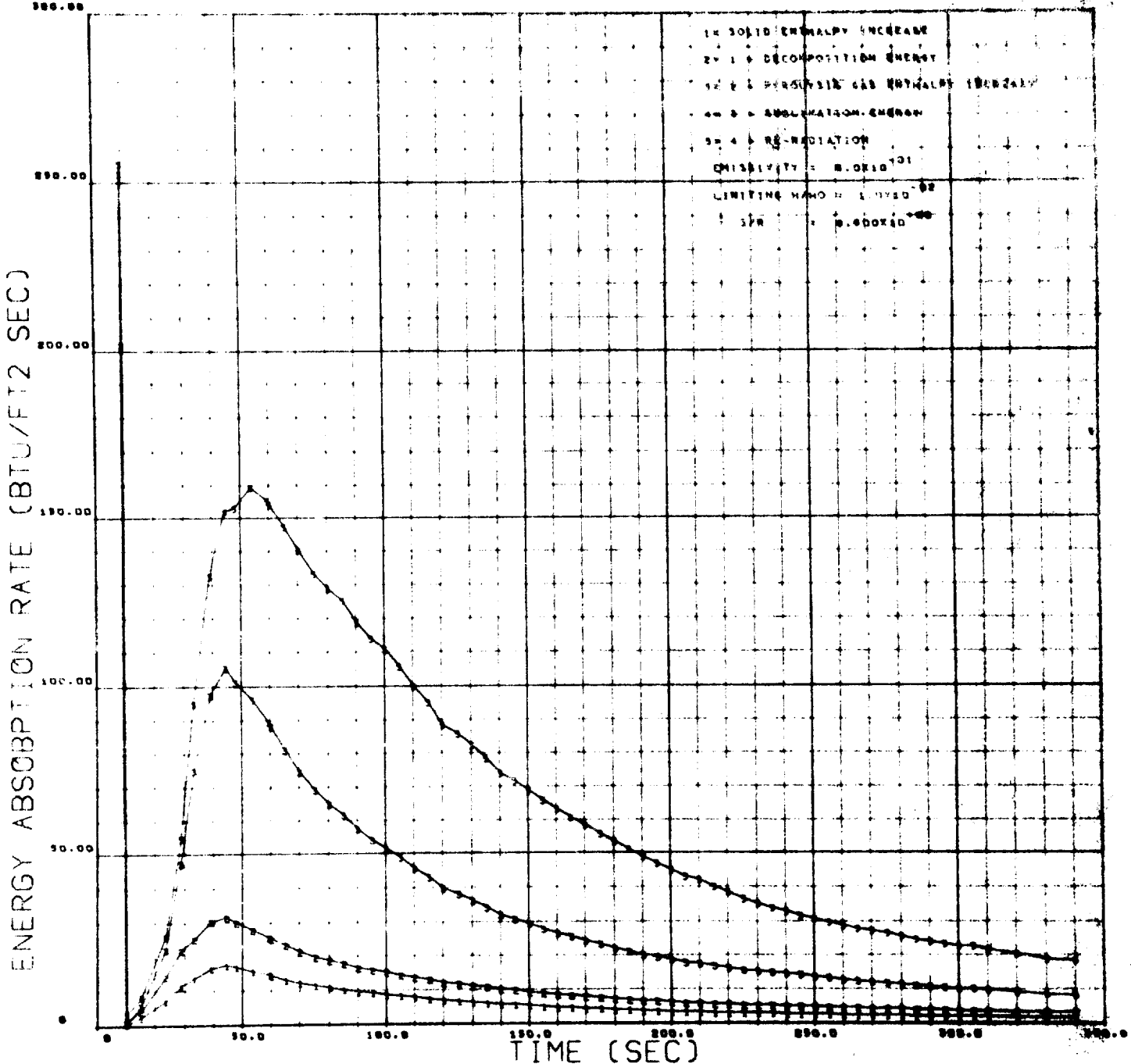


FIGURE B28

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=37000 - TRAJECTORY LB-68 AND LB-67

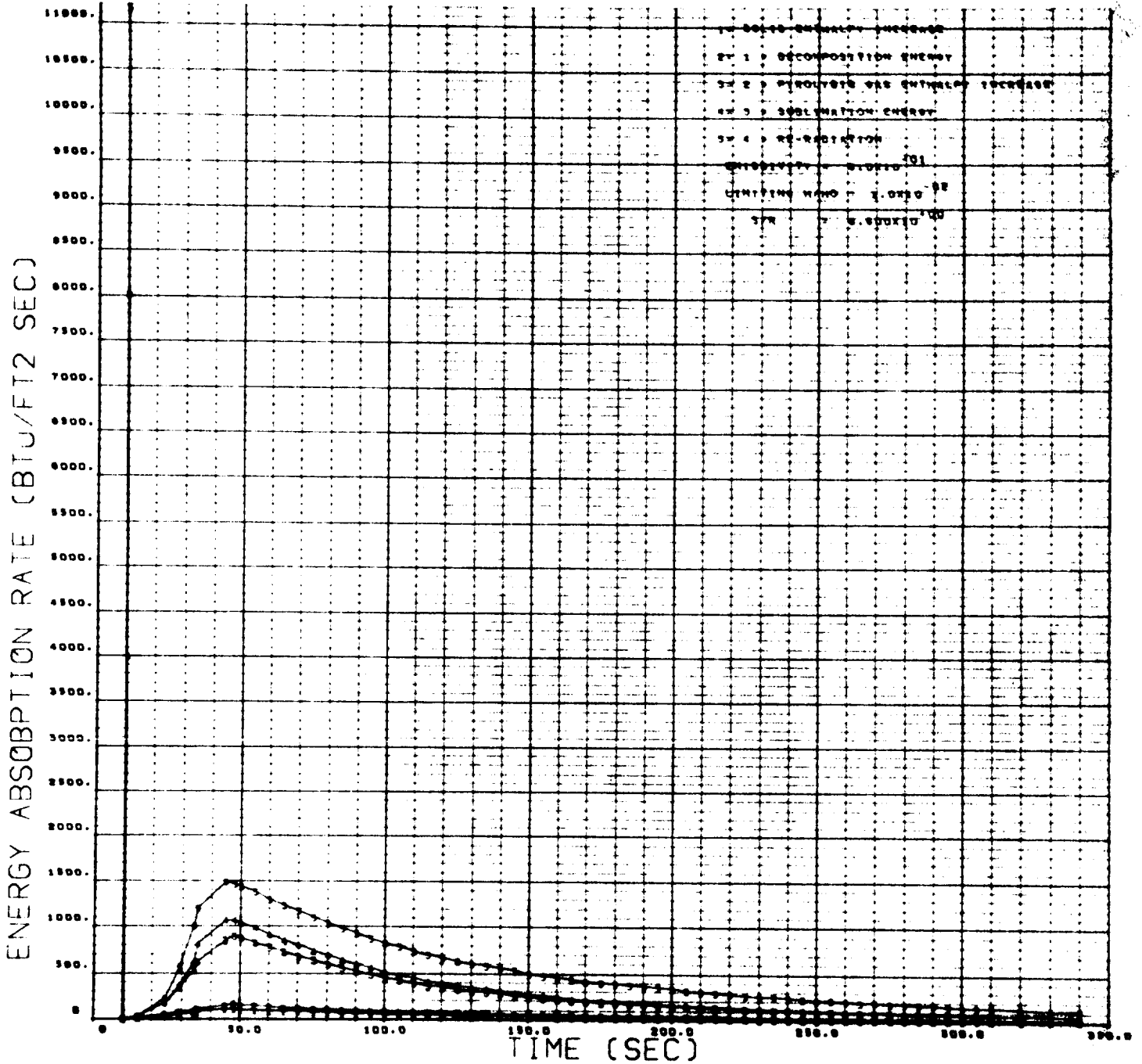


FIGURE B28

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VELOCITY TRAJECTORY LB-88 AND LB-89

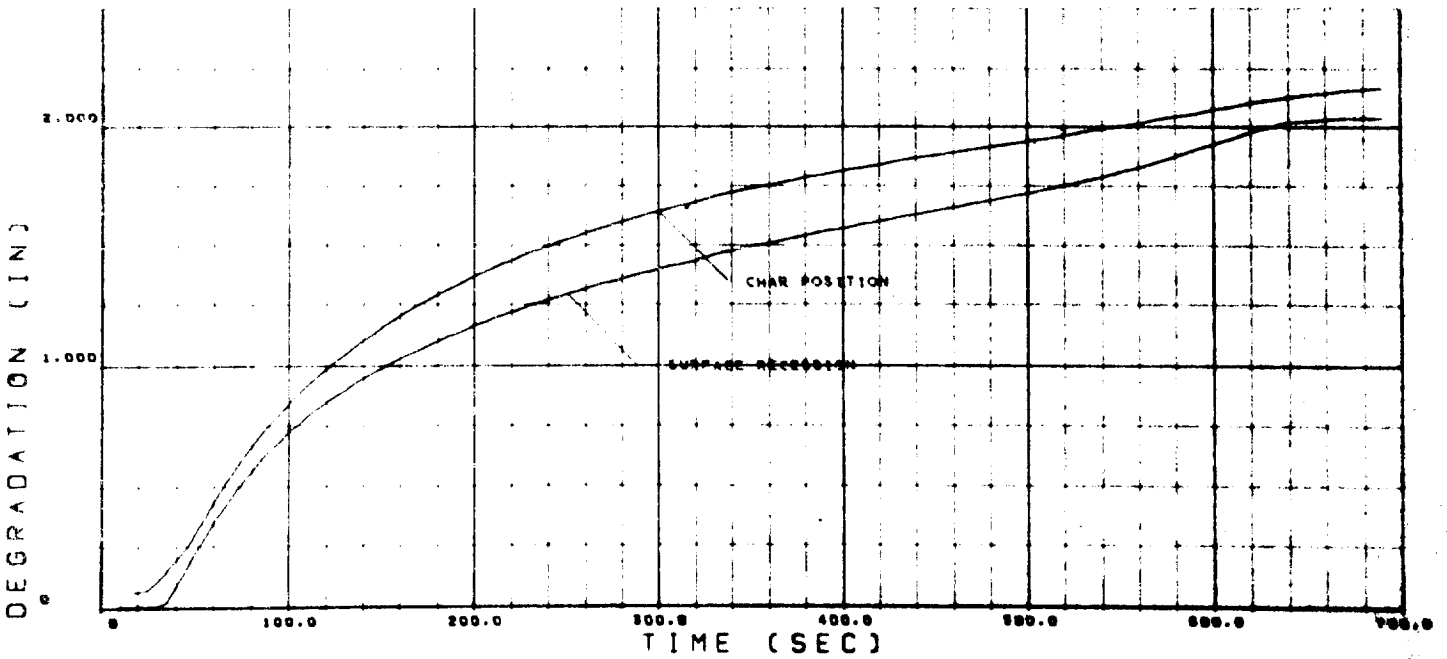
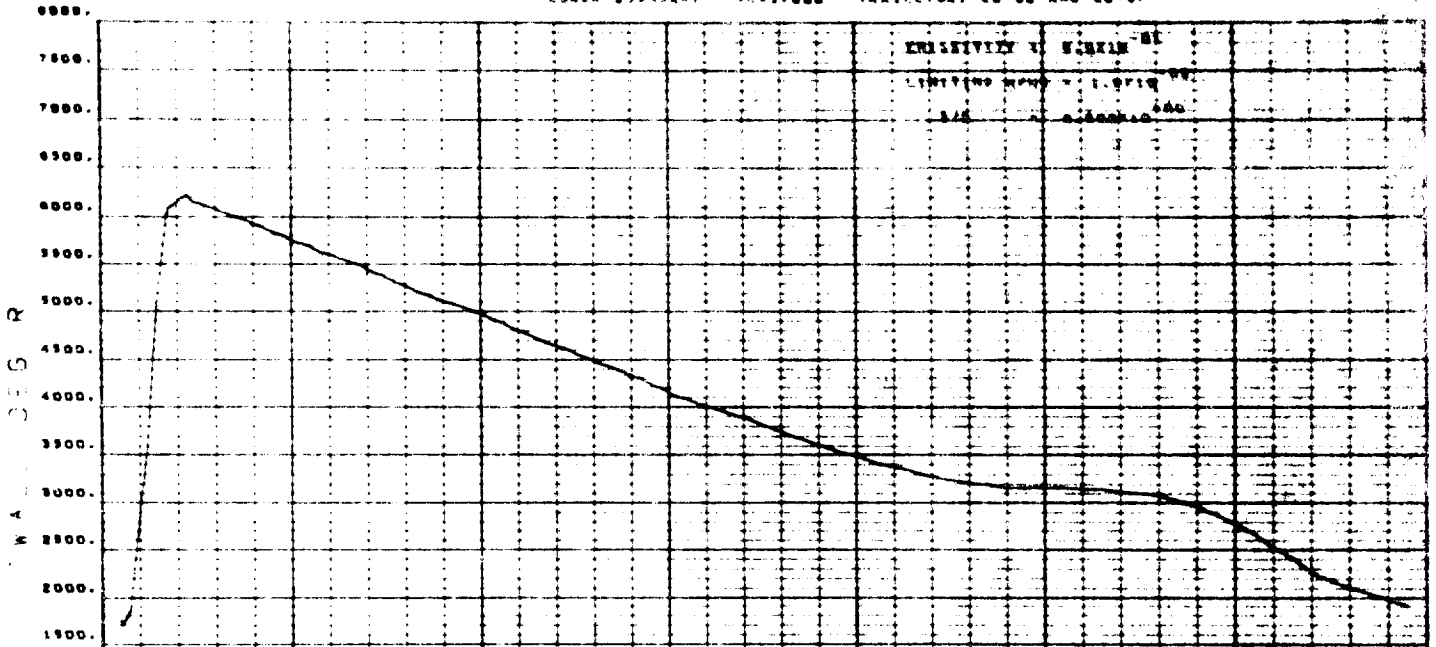


FIGURE B28

HEATING RATE HISTORY

LOWER BOUNDARY - VE=37000 - TRAJECTORY LB-66 AND LB-67

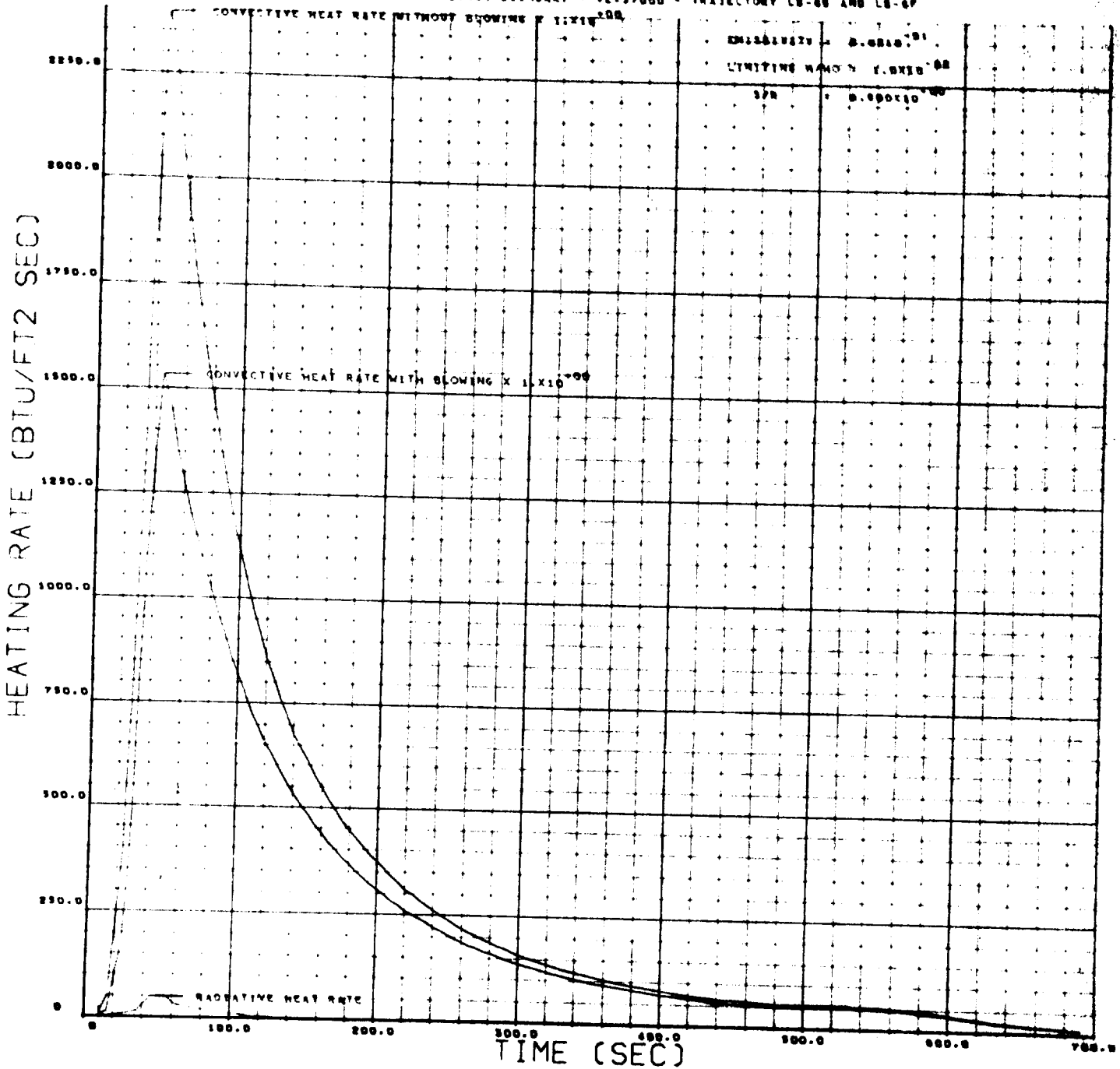


FIGURE B.2.9

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=37000 - TRAJECTORY LB-00 AND LB-07

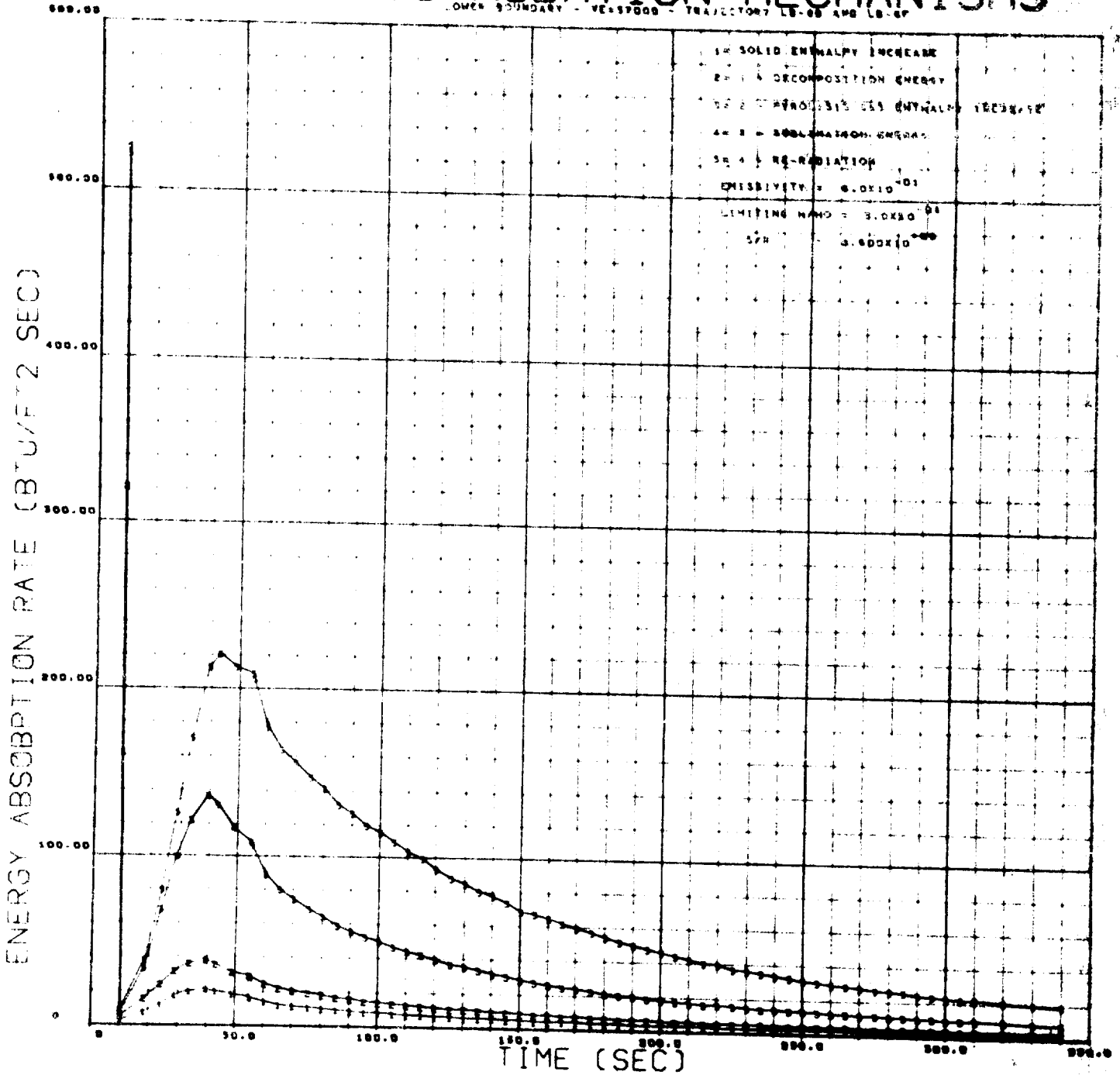


FIGURE B29

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VE=57000 - TRAJECTORY LU-06 AND LU-07

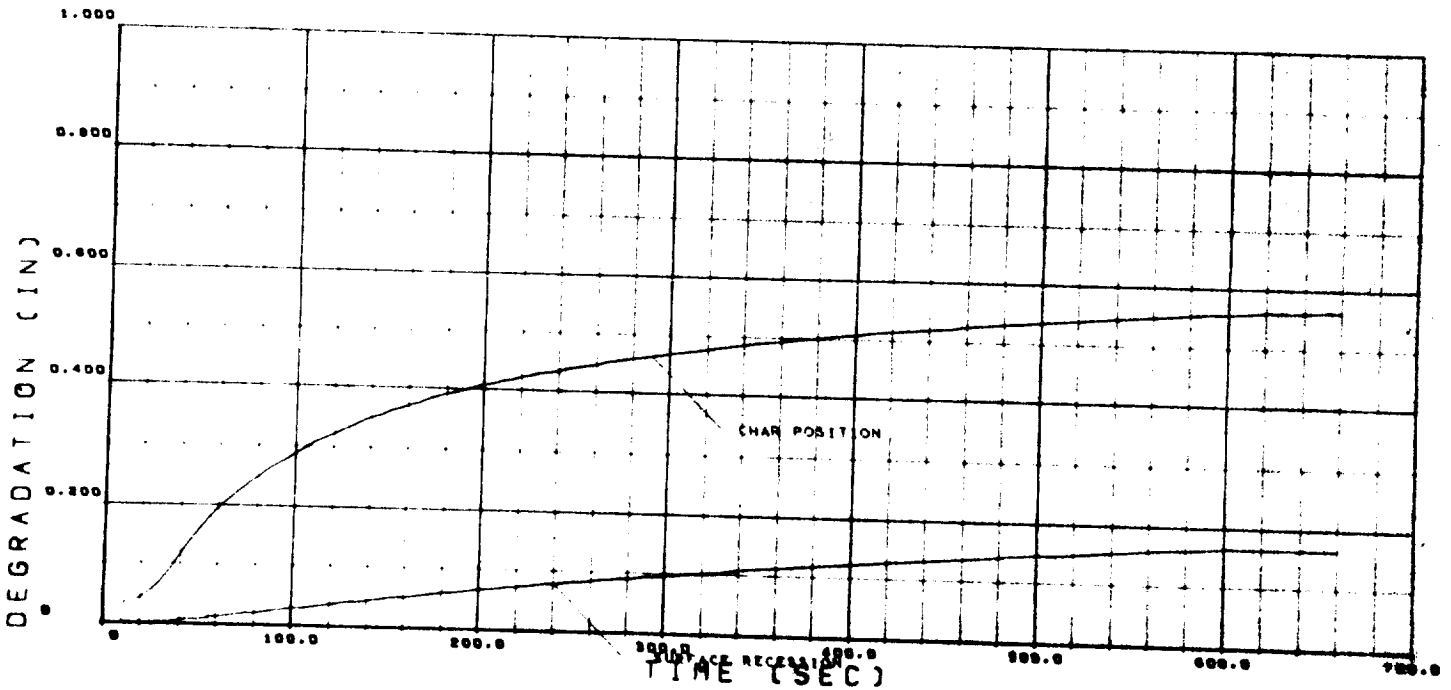
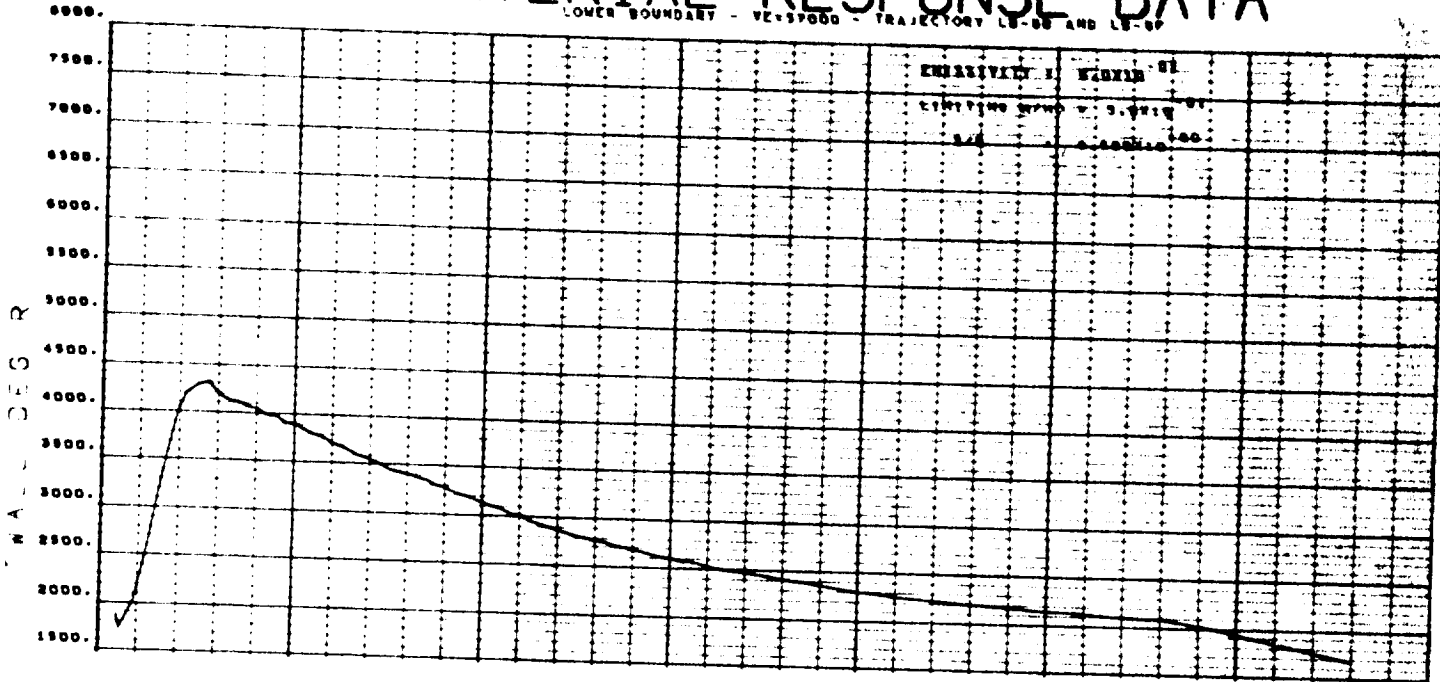


FIGURE B29

HEATING RATE HISTORY

LOWER SURFACE - VE-57000 - TRAJECTORY LB-66 AND LB-67

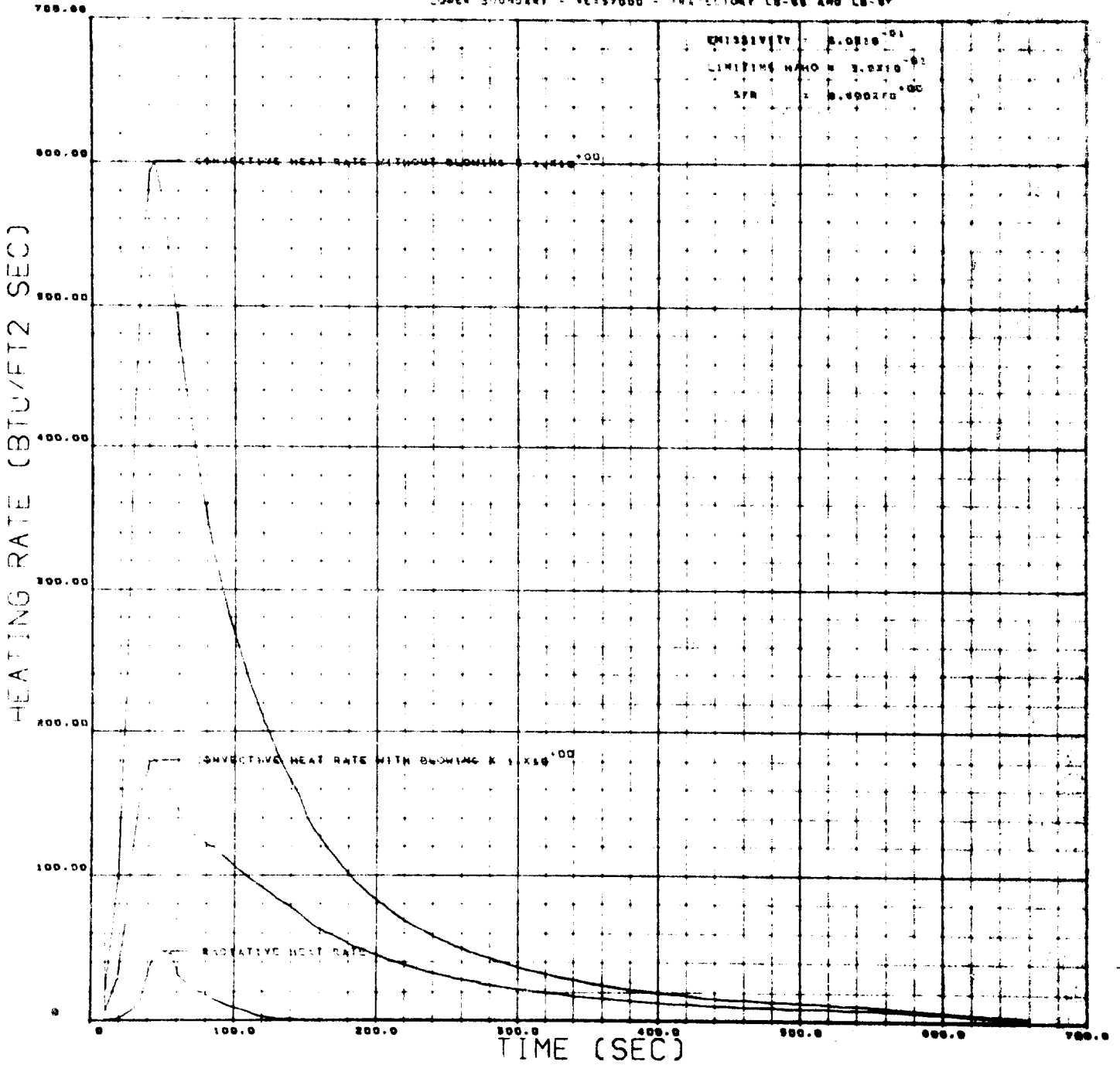


FIGURE D30

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VC-57000 - TRAJECTORY LB-88 AND LB-87

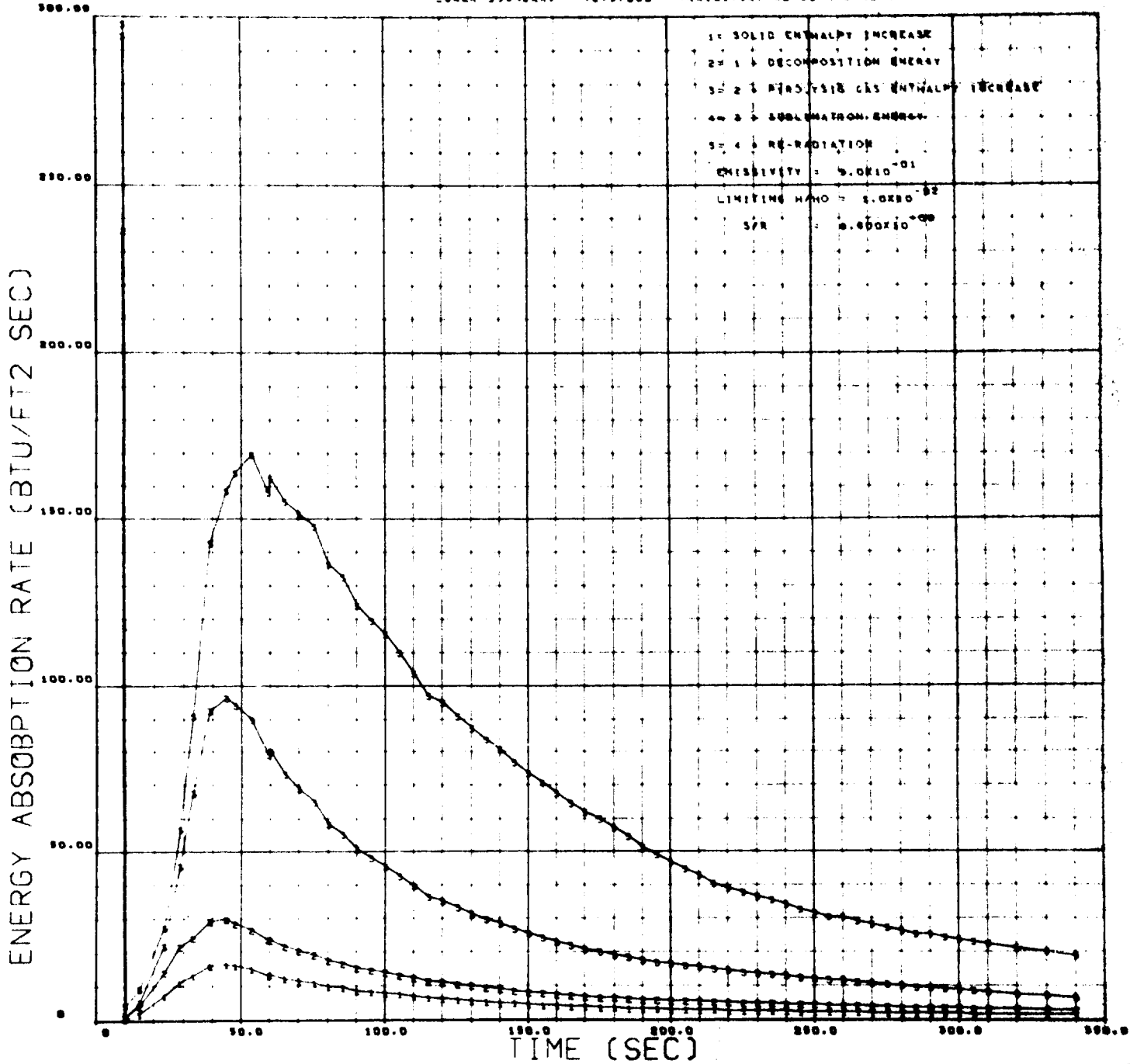
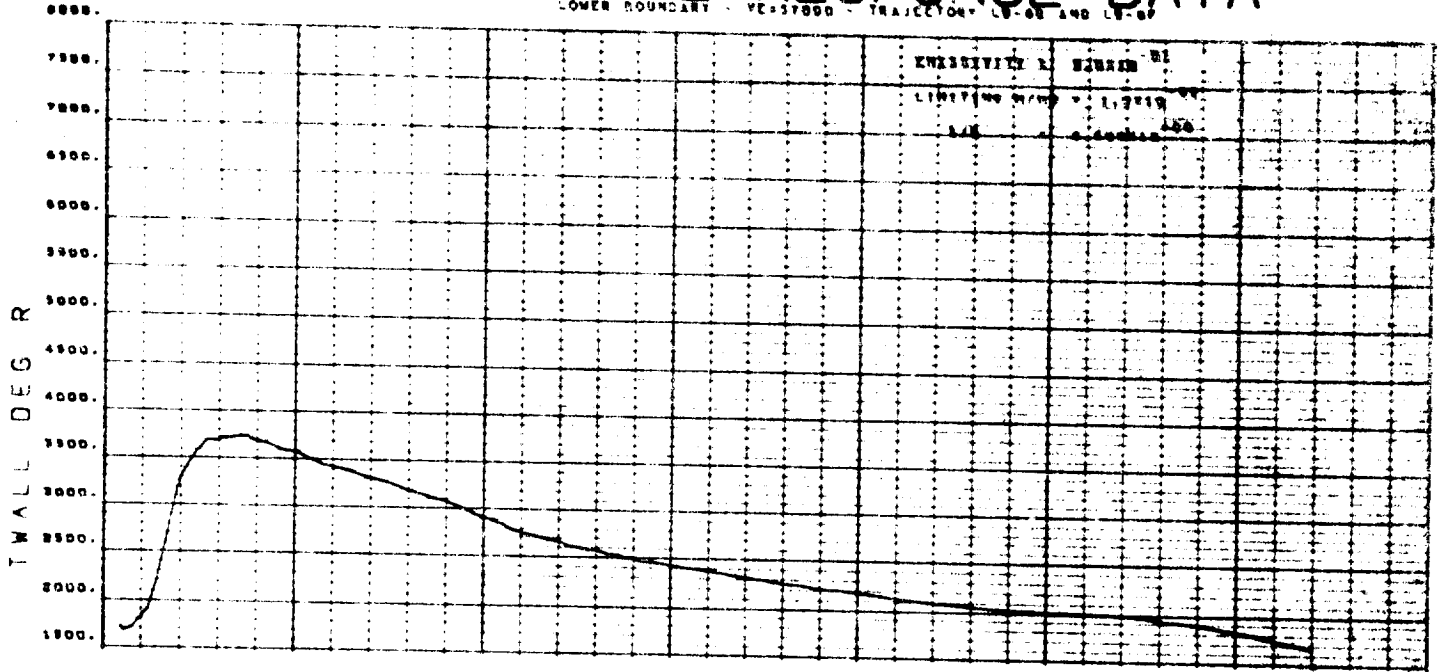


FIGURE B30

MATERIAL RESPONSE DATA

LOWER BOUNDARY VE=37500 TRAJECTORY LU-08 AND LU-09



EXPOSURE TIME 21
LIMITING WIND = 1.7519
S/L 2.40000 450

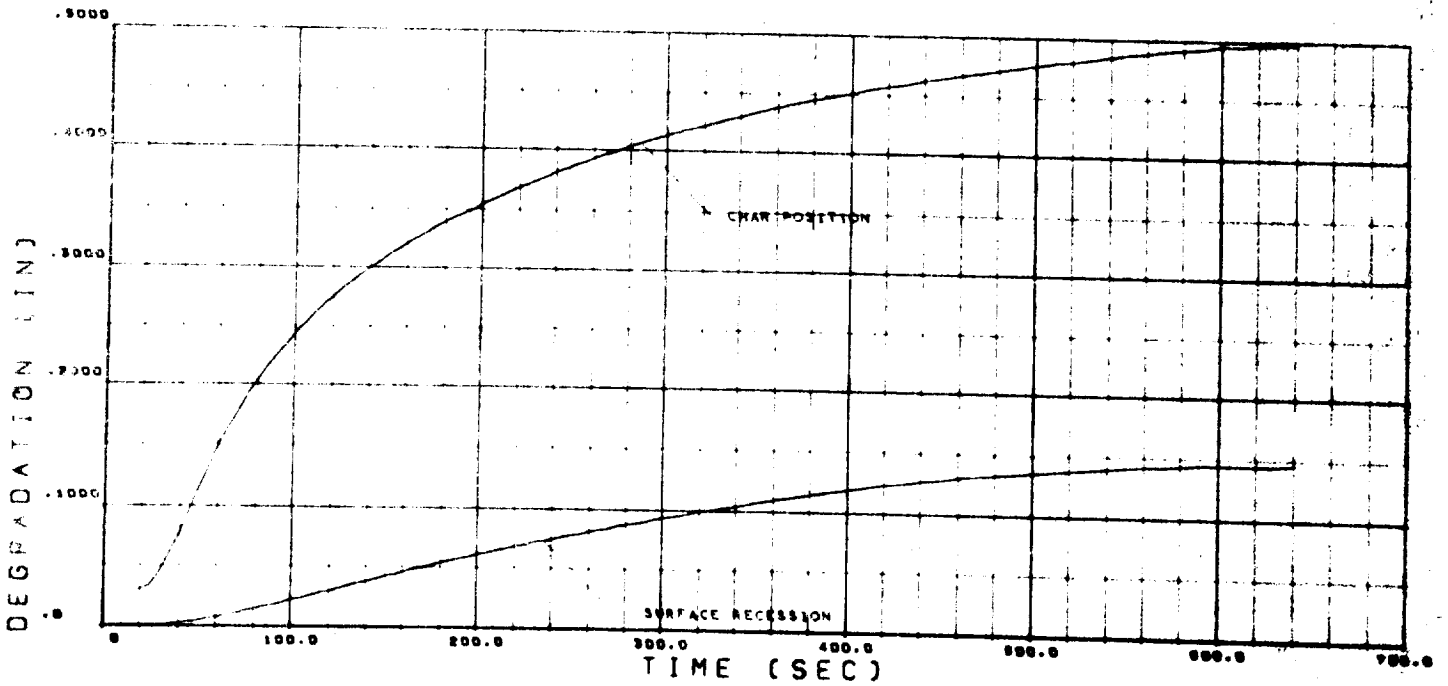


FIGURE D30

HEATING RATE HISTORY

LOWER BOUNDARY - VE=57000 - TRAJECTORY LB-68 AND LB-67

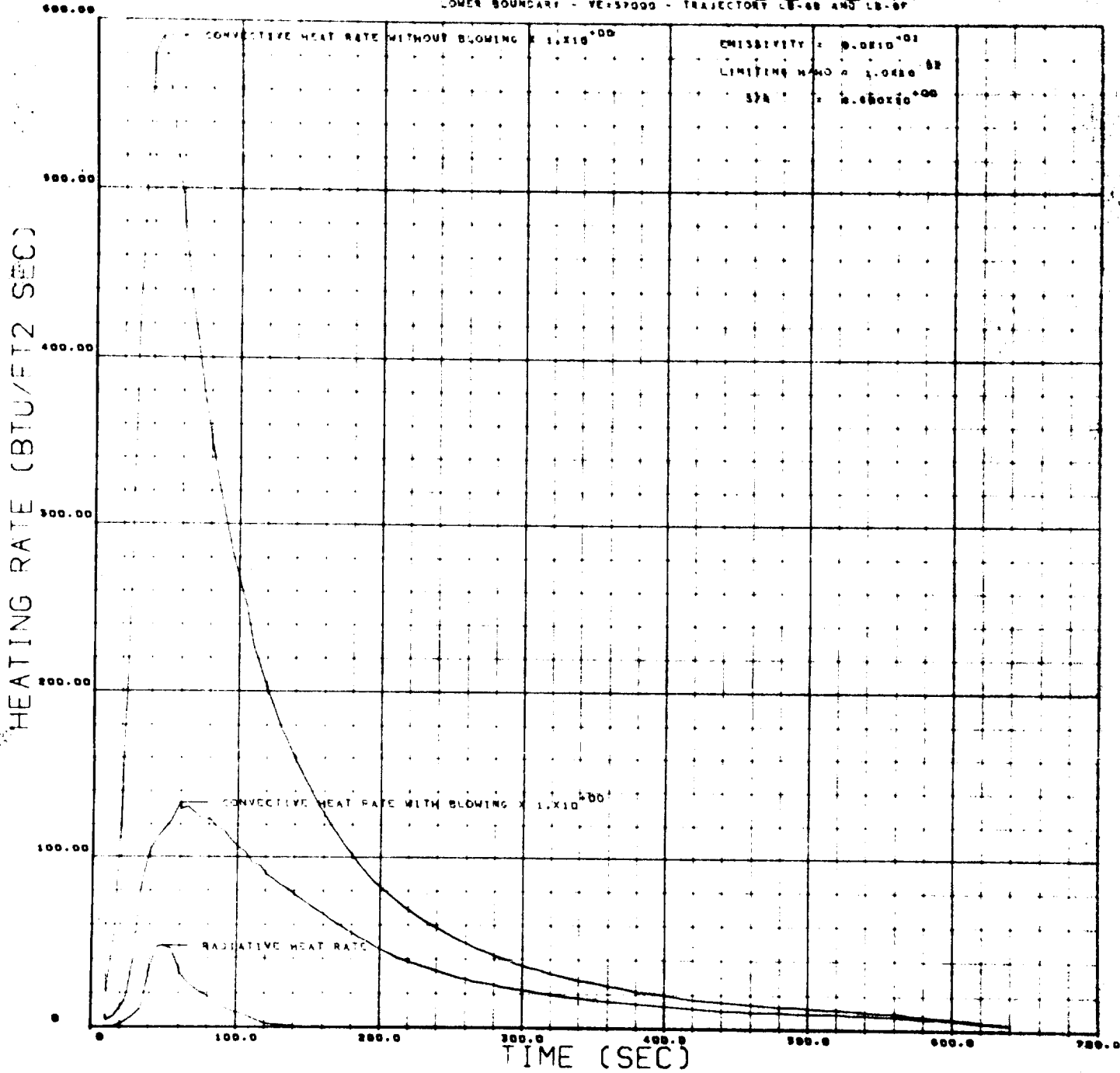


FIGURE B31

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE=37000 - TRAJECTORY LB-08 AND LB-07

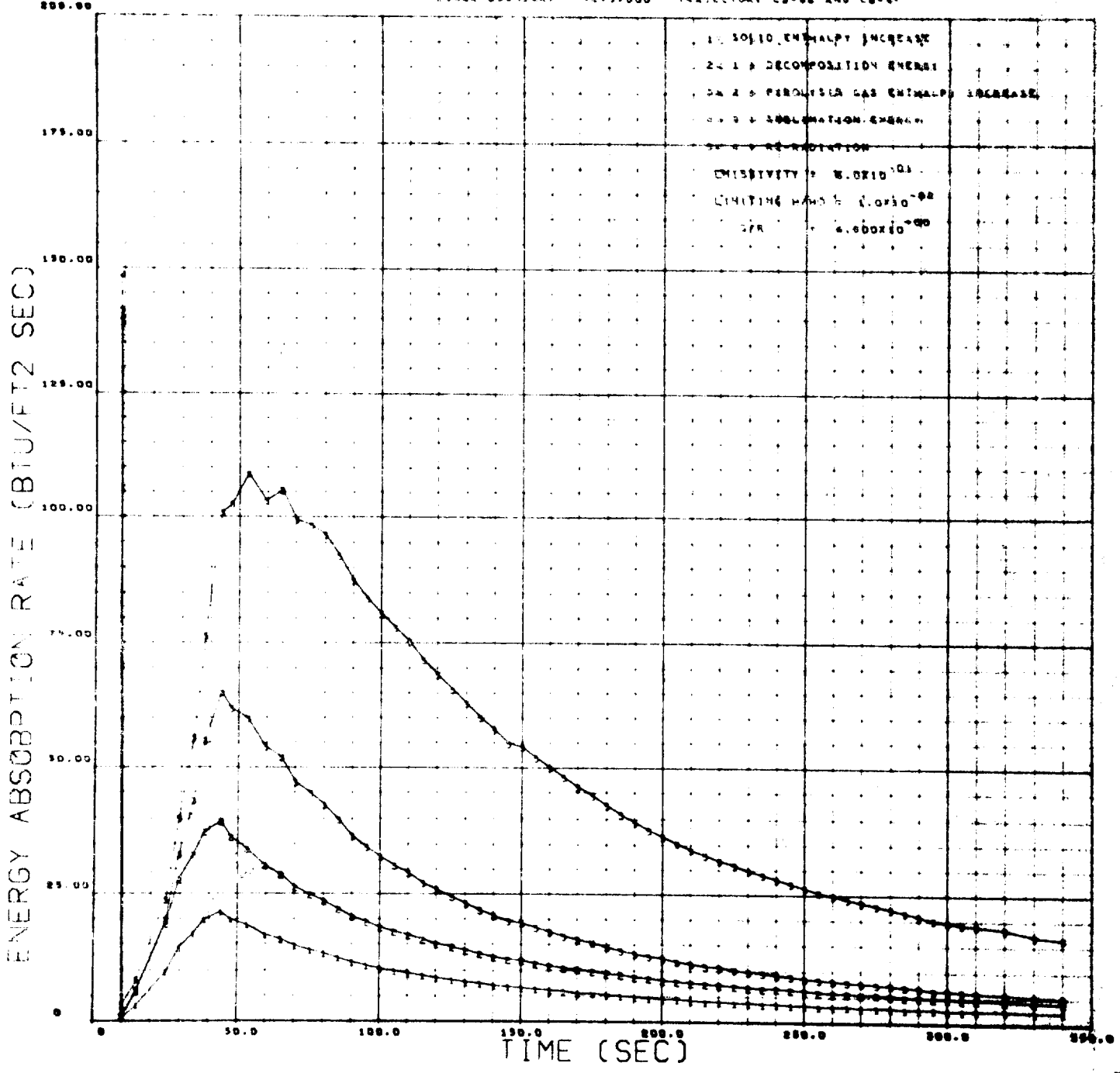


FIGURE B31

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VE=37000 - TRAJECTORY LB-05 AND LB-07

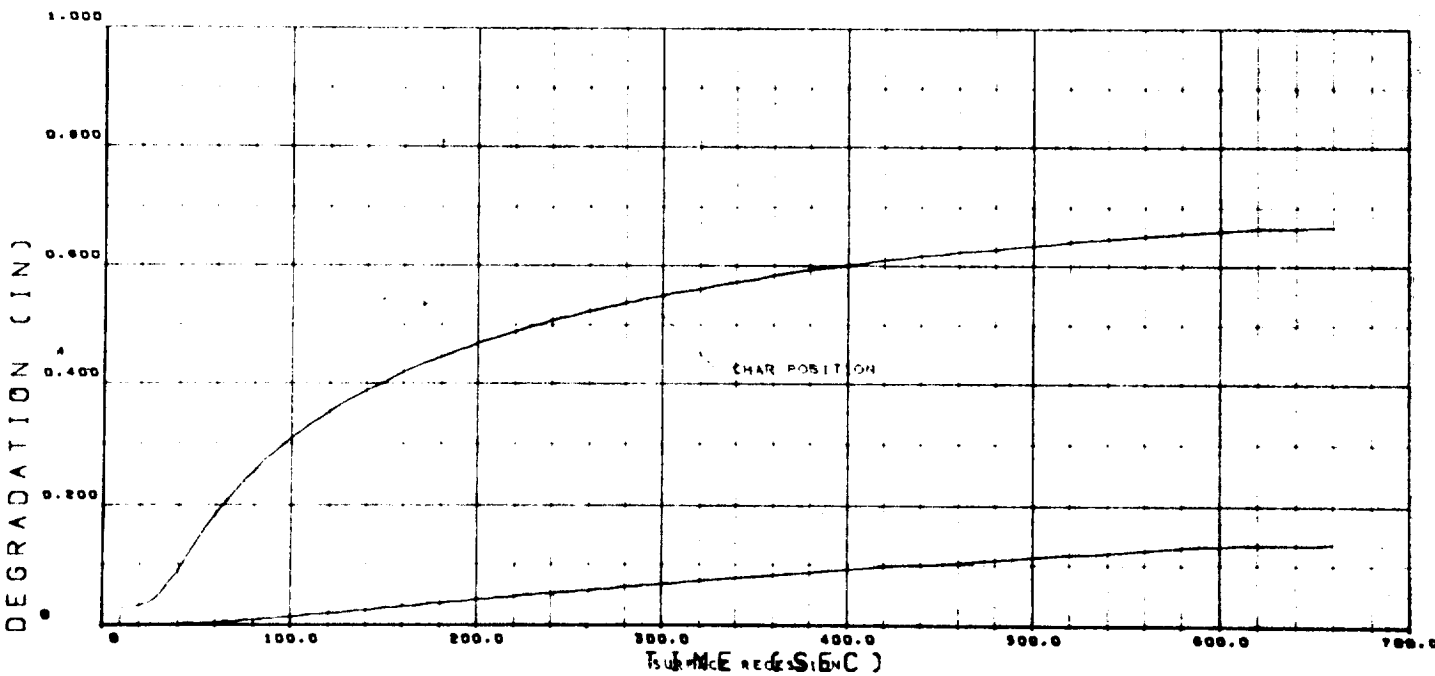
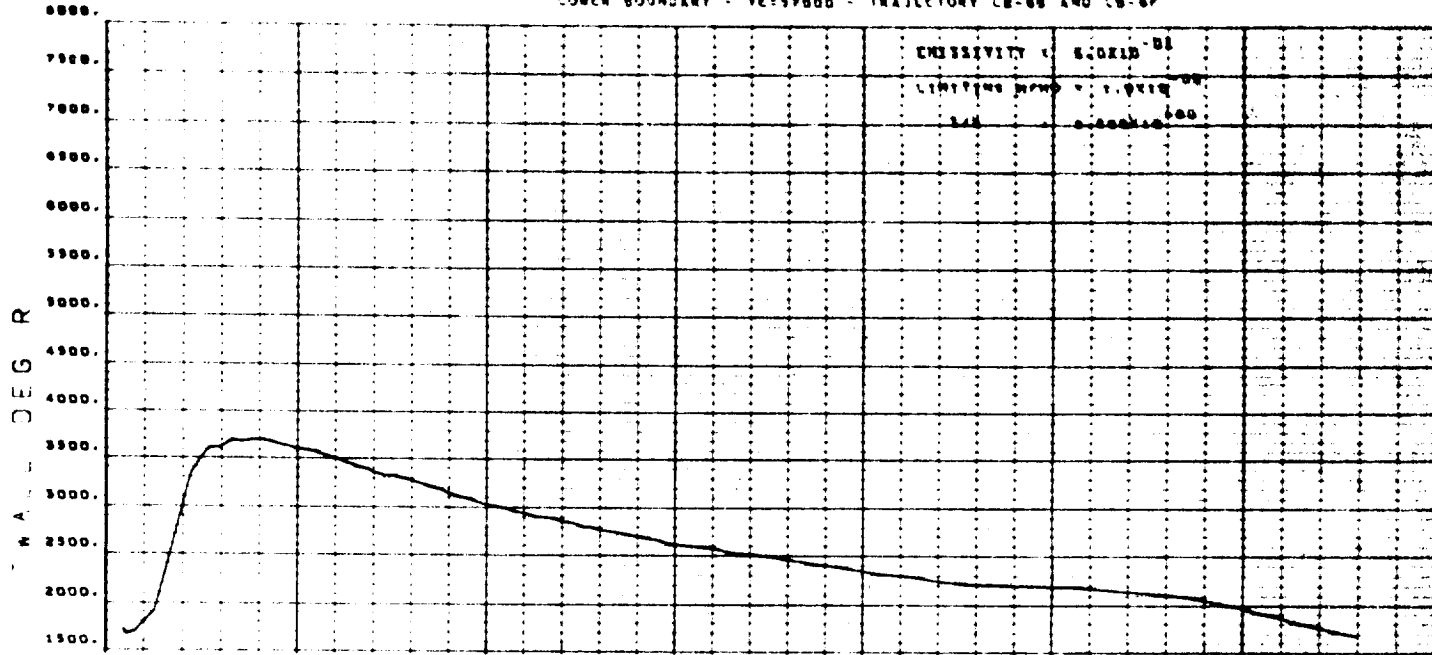


FIGURE B31

HEATING RATE HISTORY

LOWER BOUNDARY - VE: 57000 - TRAJECTORY LB-60 AND LB-67

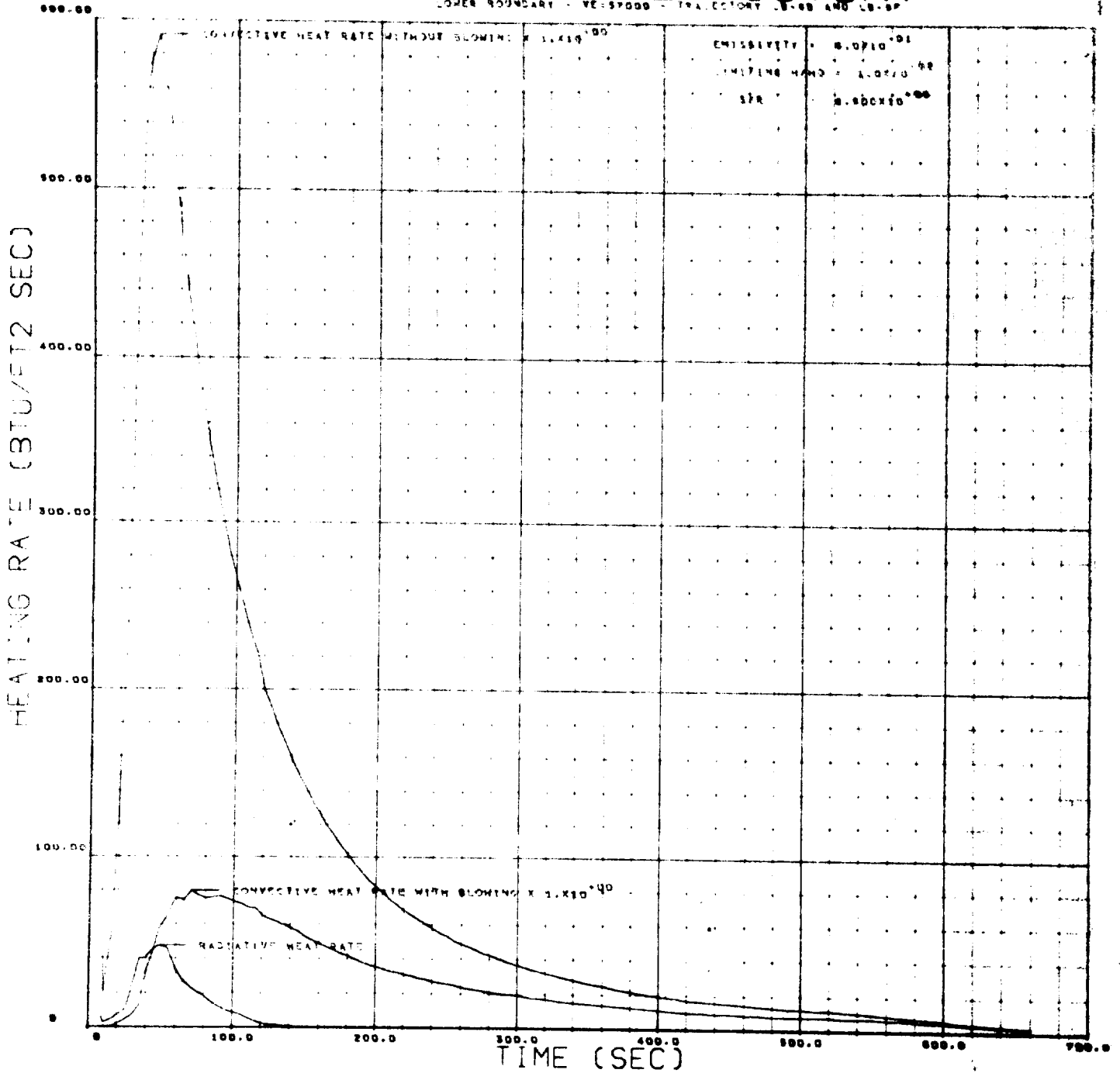


FIGURE B32

ENERGY ACCOMMODATION MECHANISMS

LOWER BOUNDARY - VE-37500 - TRAJECTORY LB-66 AND LB-67

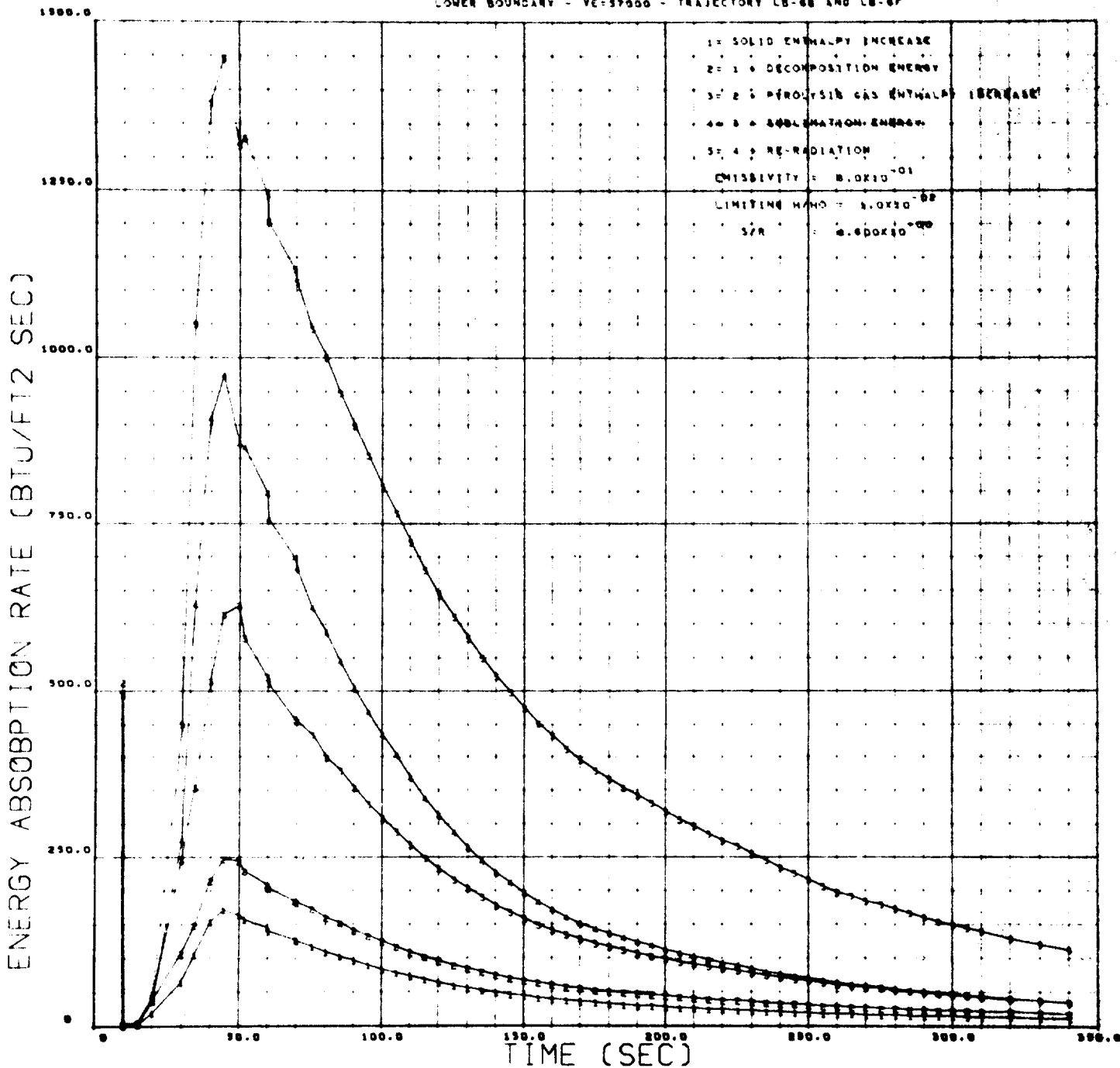


FIGURE 032

MATERIAL RESPONSE DATA

LOWER BOUNDARY - VE=37000 - TRAJECTORY - 0-00 AND 0-07

EXPOSURE	0.0010 - 01
INITIAL MASS	1.0000
RESIDUAL MASS	0.0000

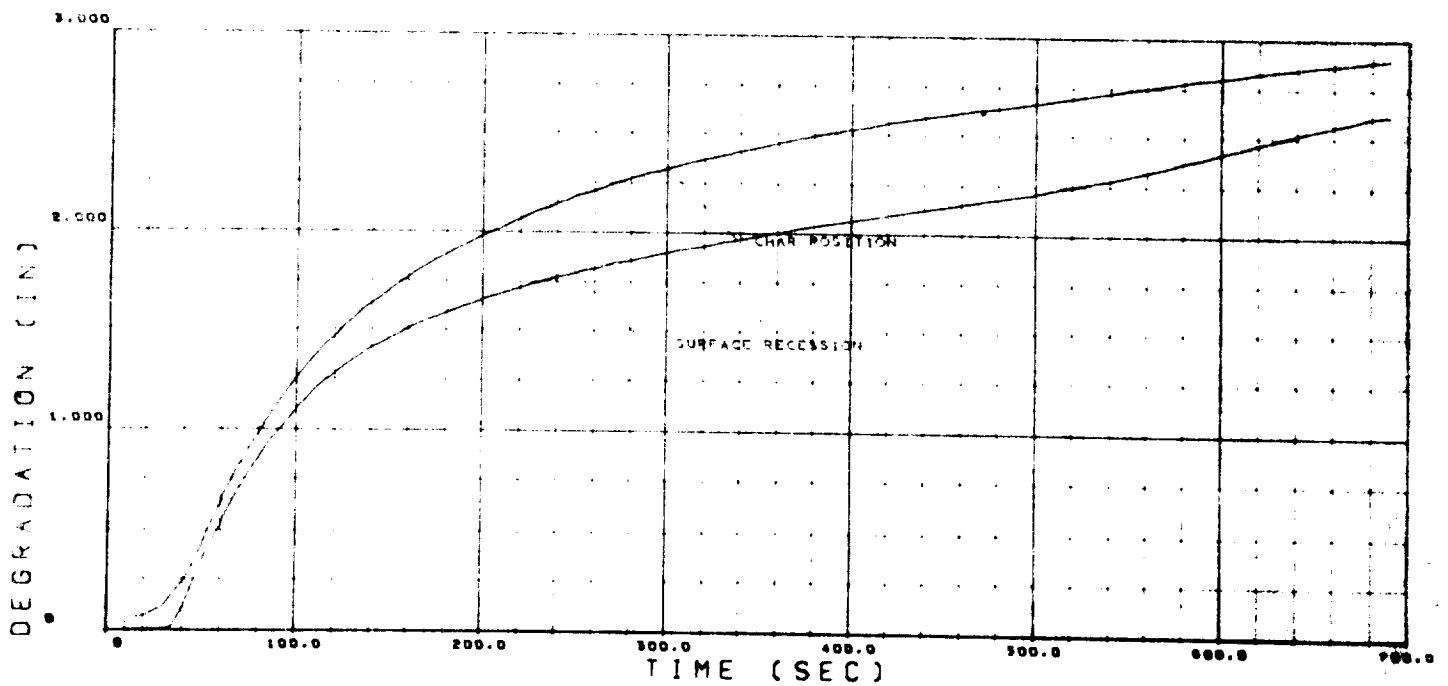
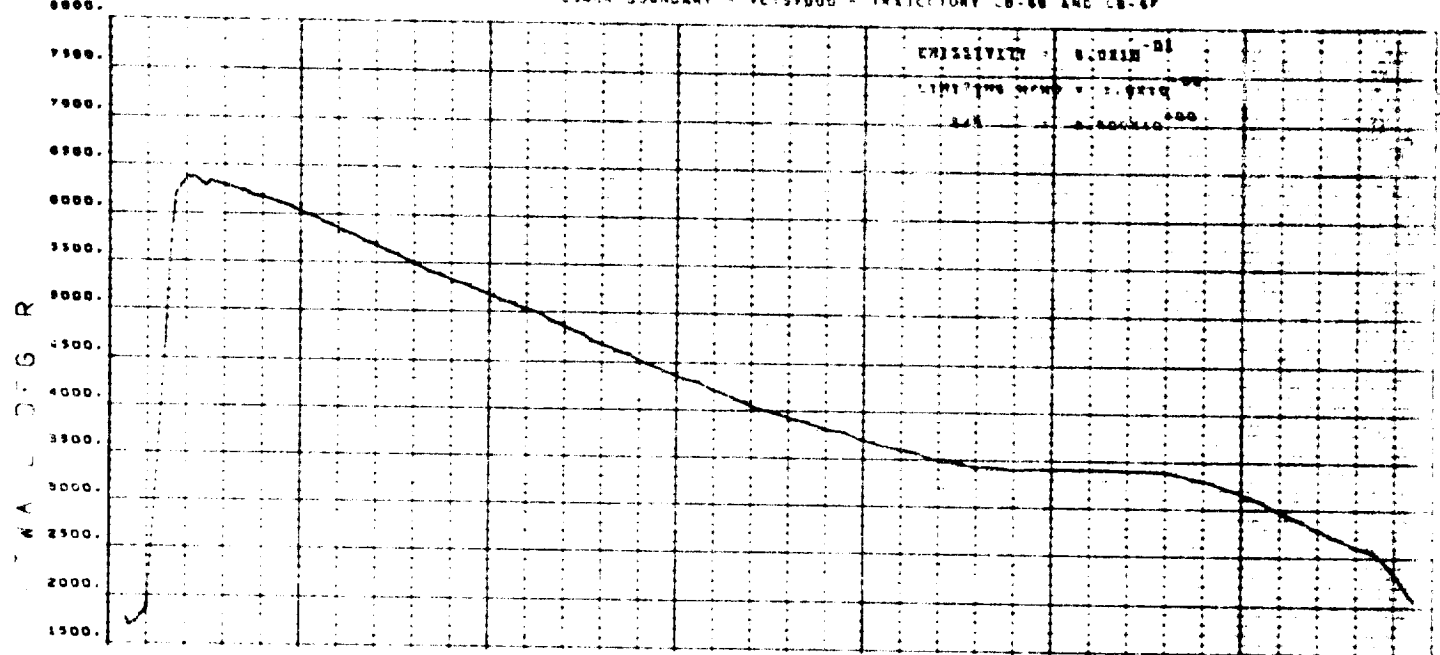


FIGURE B32

HEATING RATE HISTORY

LOWER BOUNDARY - VE=37000 - TRAJECTORY LB-68 AND LB-67

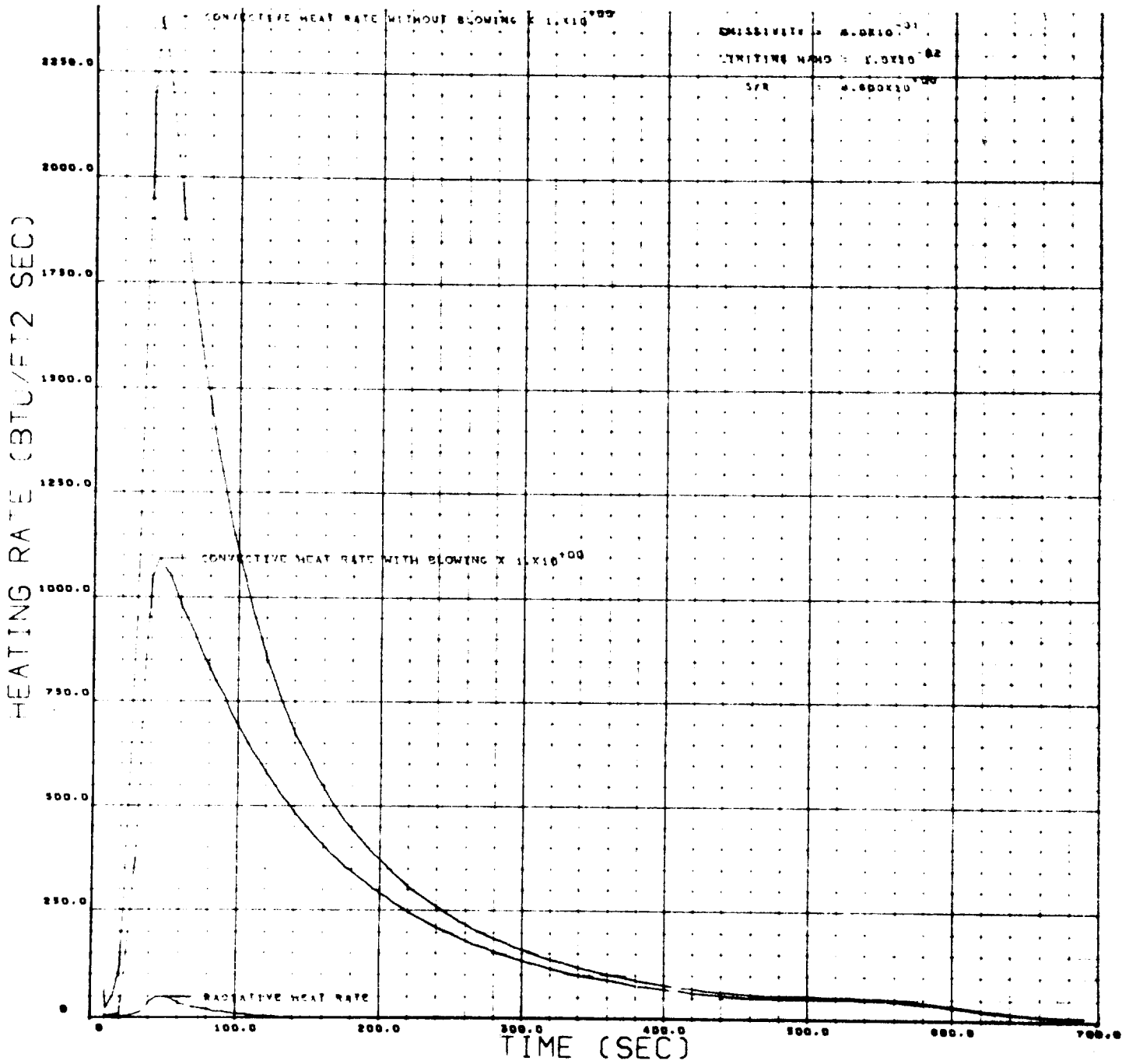


FIGURE B33

HEATING RATE HISTORY

JETTER BOUNDARY - VELOCITY 45000 - TRAJECTORY 08-48 AND 08-47

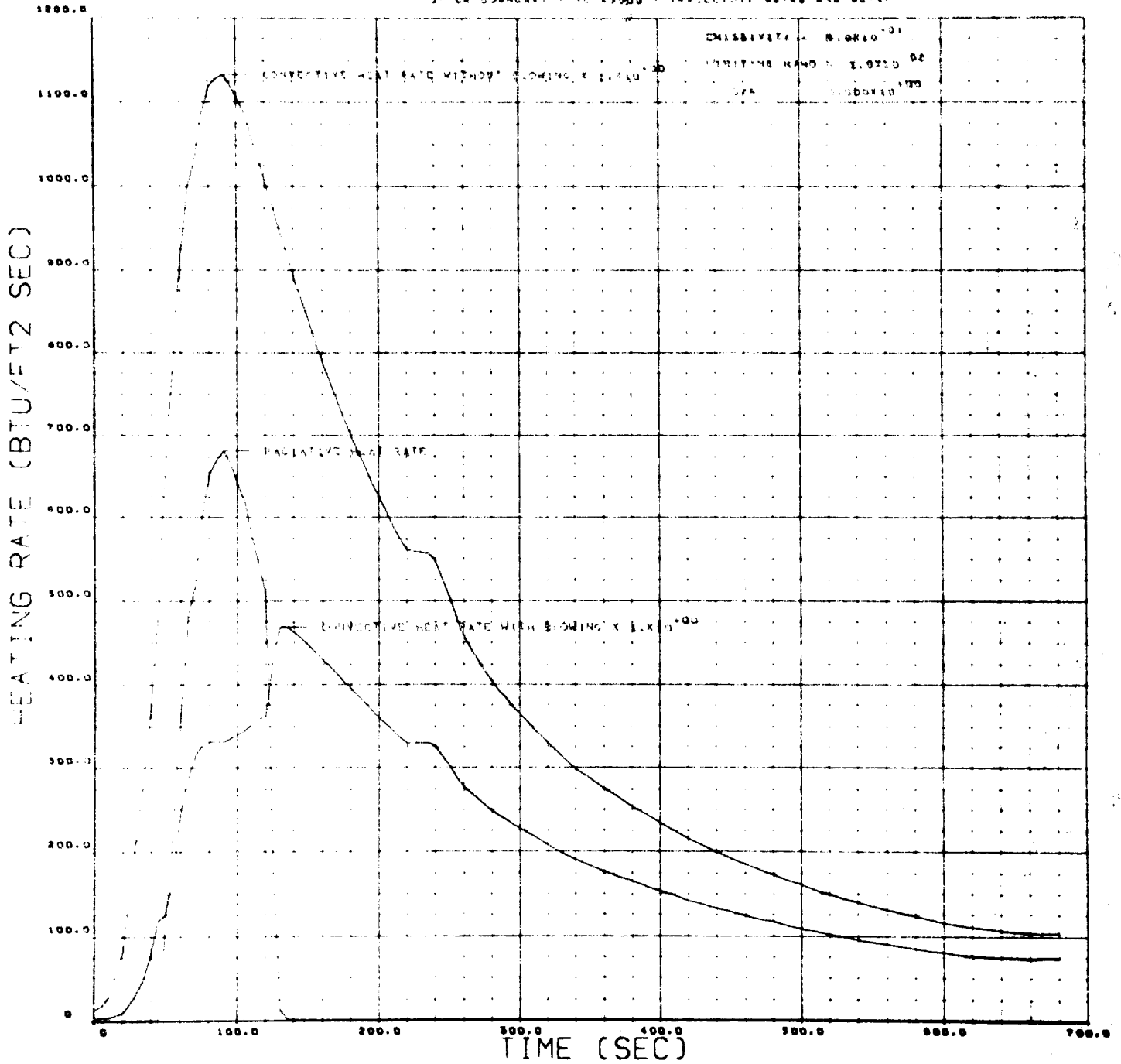


FIGURE 1B33

MATERIAL RESPONSE DATA

UPPER BOUNDARY - VE 45000 TRAJECTORY 08-48 AND 03-47

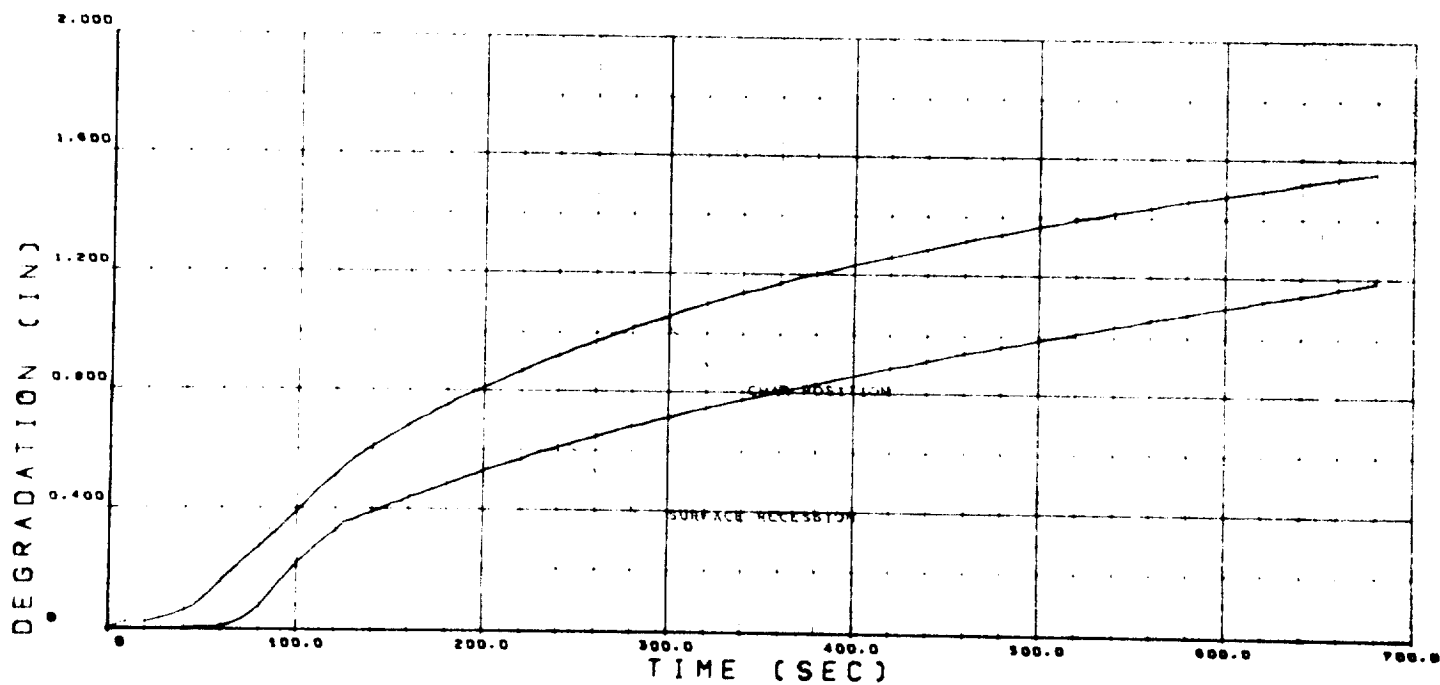
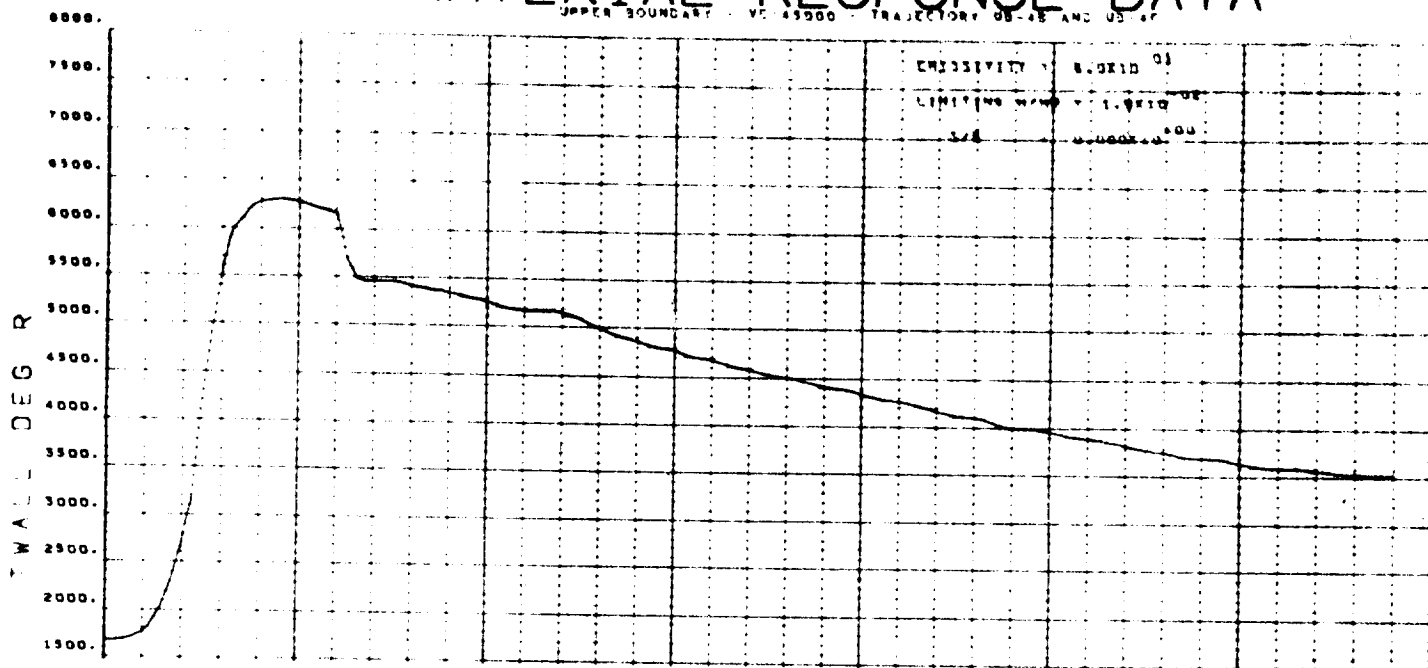


FIGURE B33

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VE=45000 - TRAJECTORY DE-45 AND UB-47

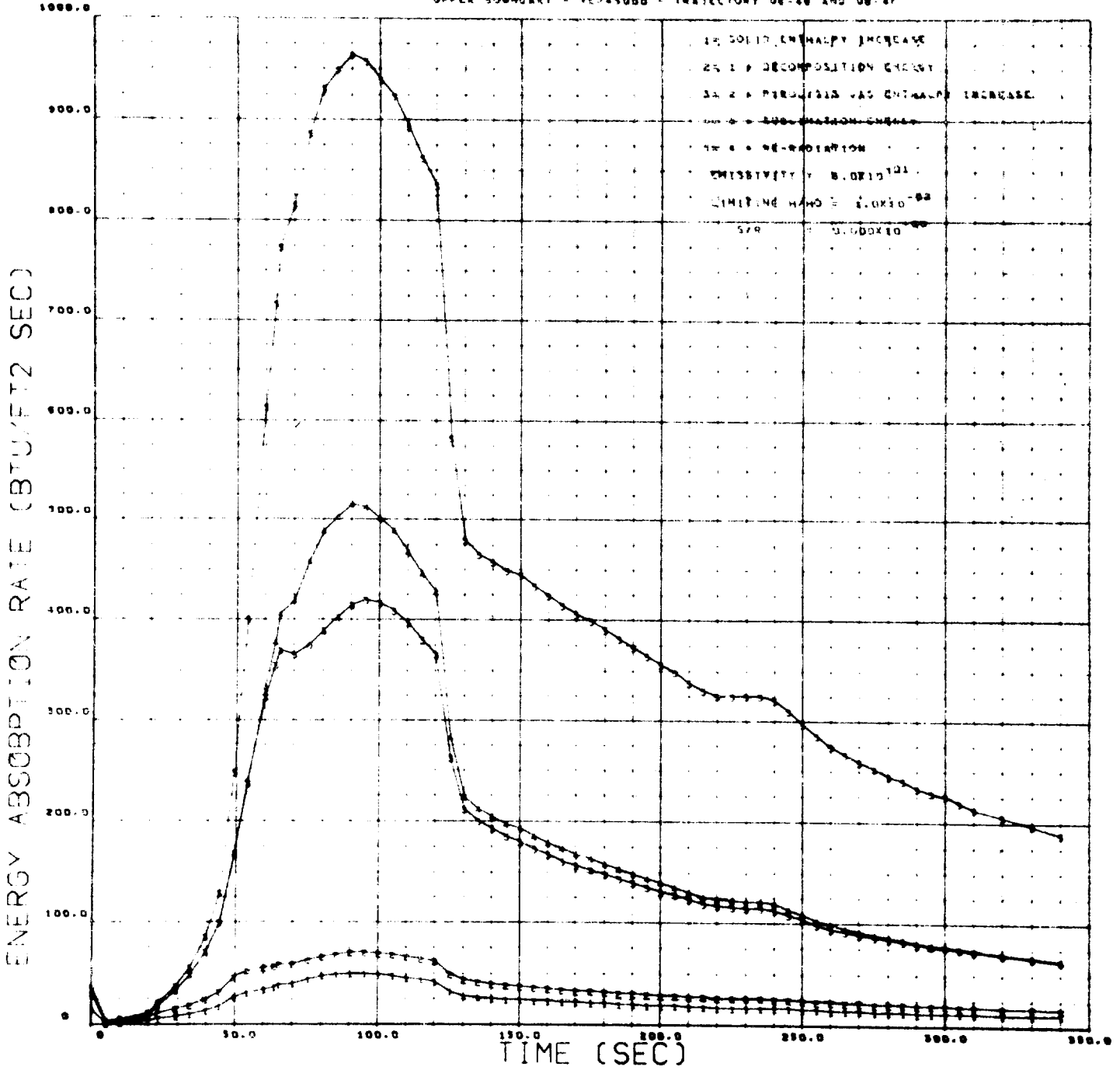


FIGURE B54

HEATING RATE HISTORY

UPPER BOUNDARY - VE=49000 - TRAJECTORY US-48 AND US-47

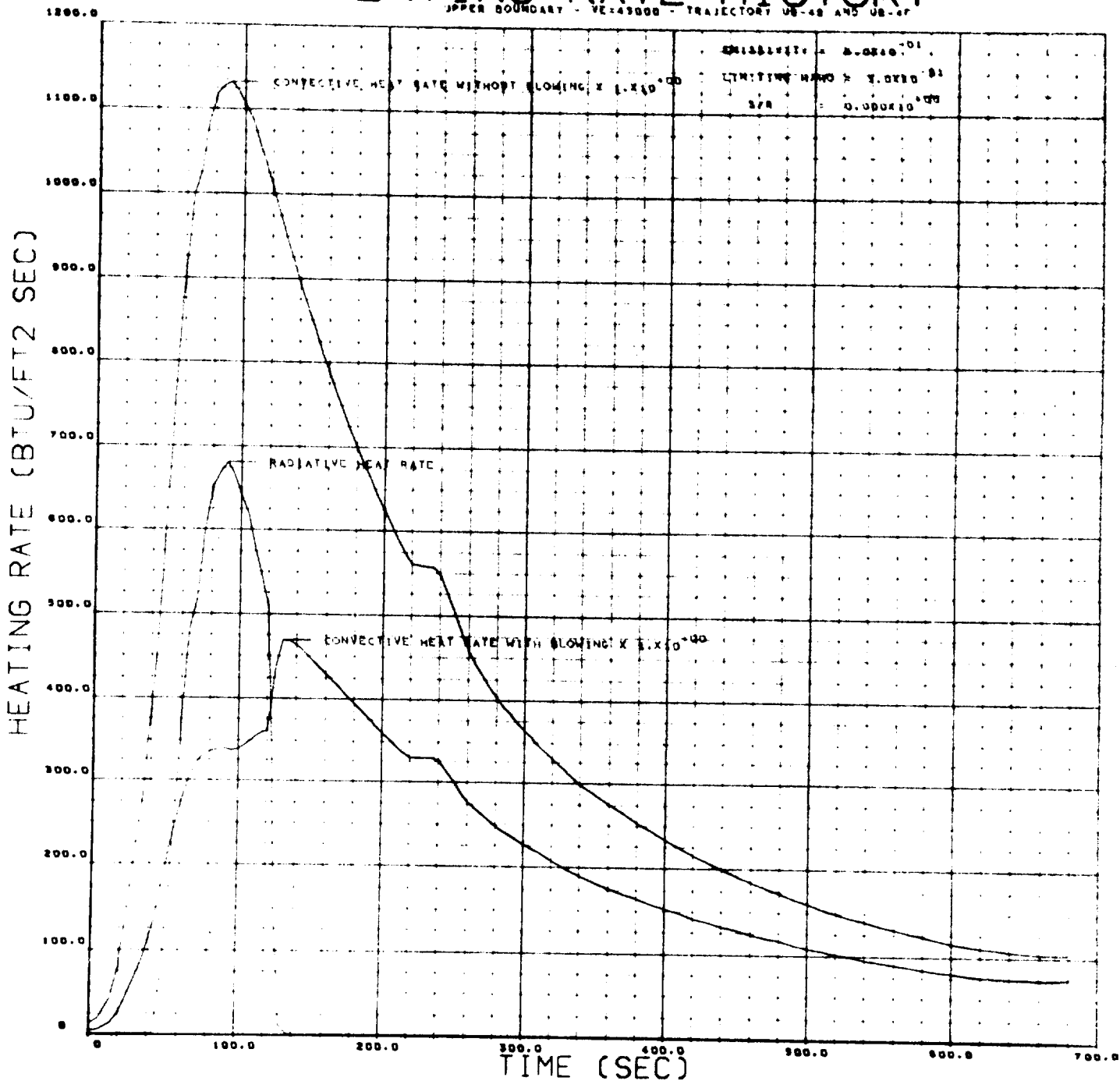


FIGURE B34

MATERIAL RESPONSE DATA

UPPER BOUNDARY - VE=49000 - TRAJECTORY VE=47 AND VE=49

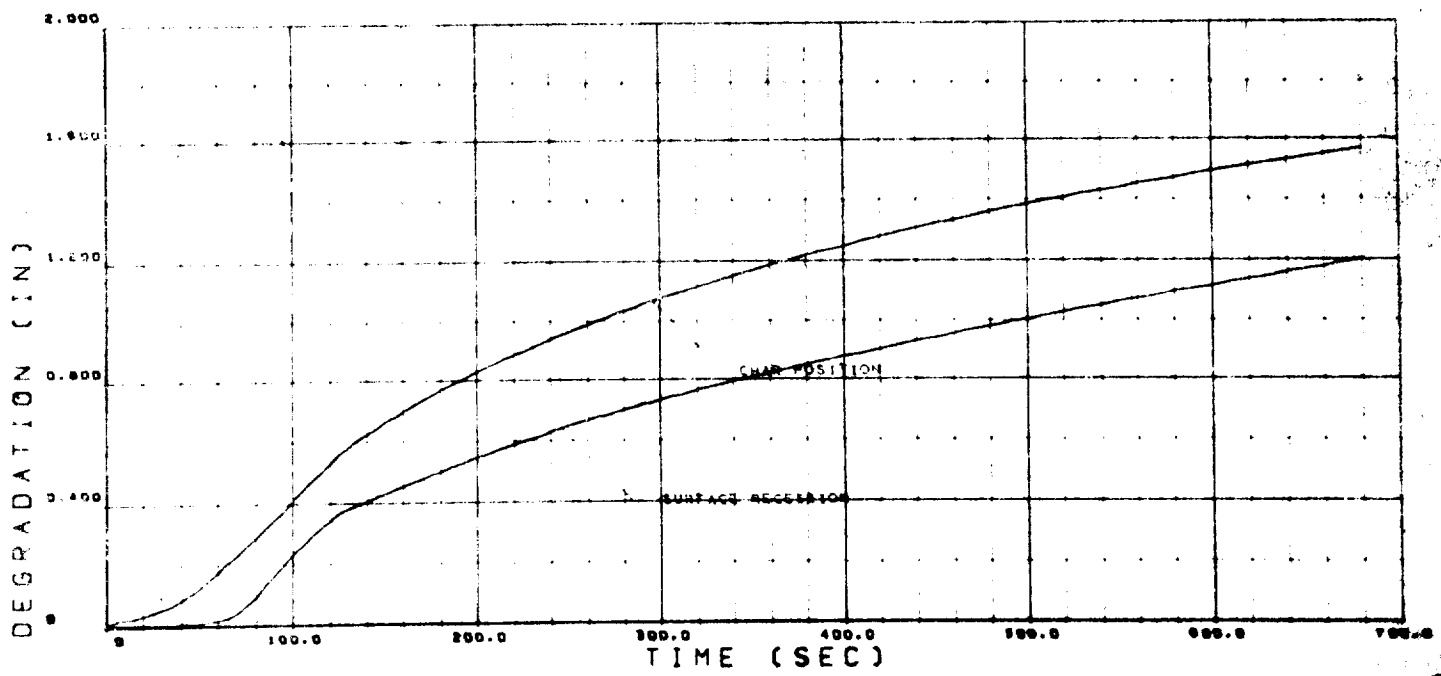
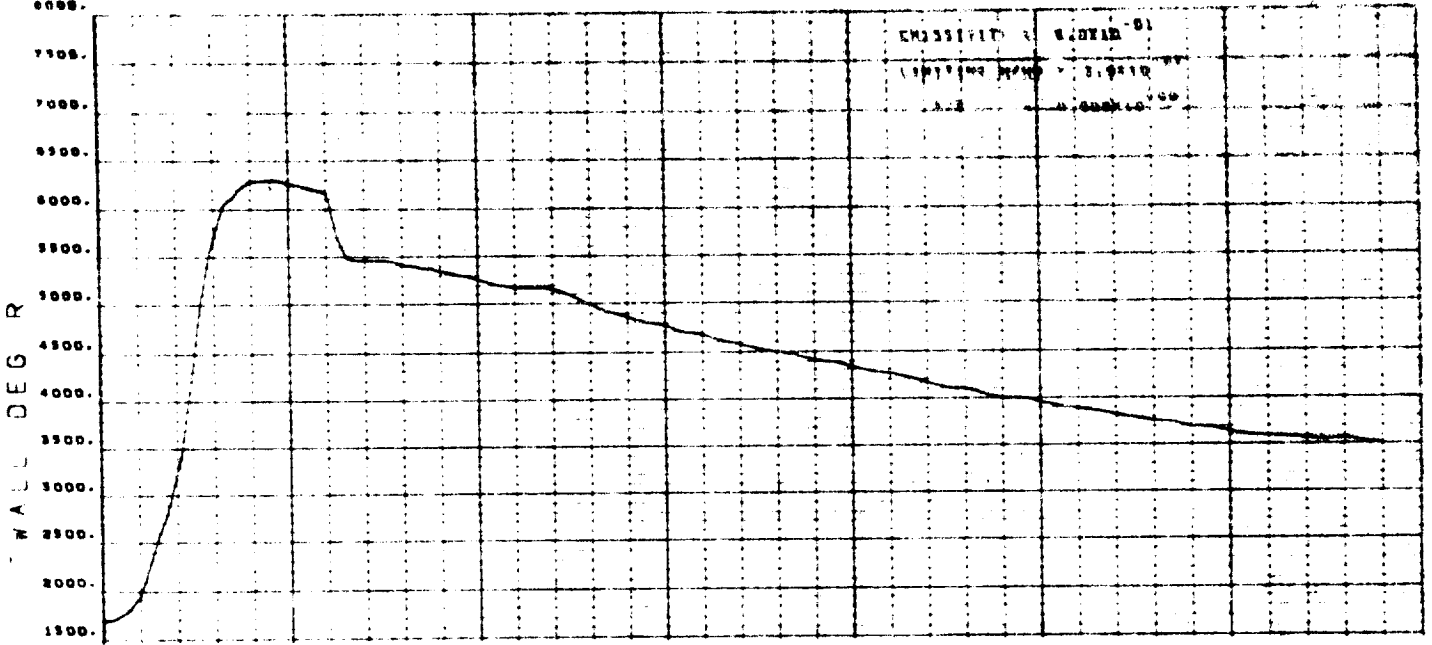


FIGURE B54

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VE=45000 - TRAJECTORY US-48 AND US-47

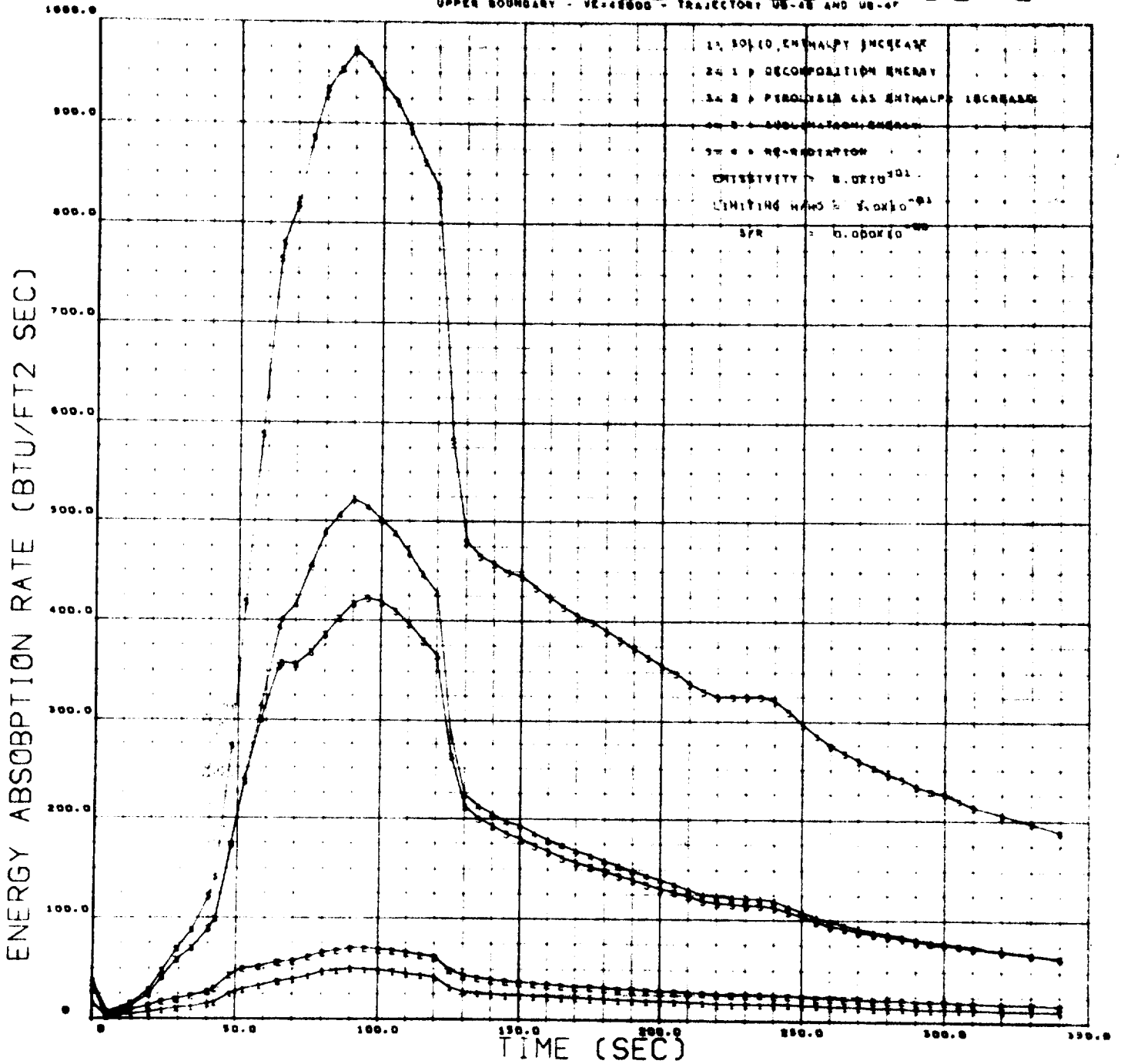


FIGURE 395

HEATING RATE HISTORY

UPPER BOUNDARY - VE=45880 - TRAJECTORY US-48 AND US-47

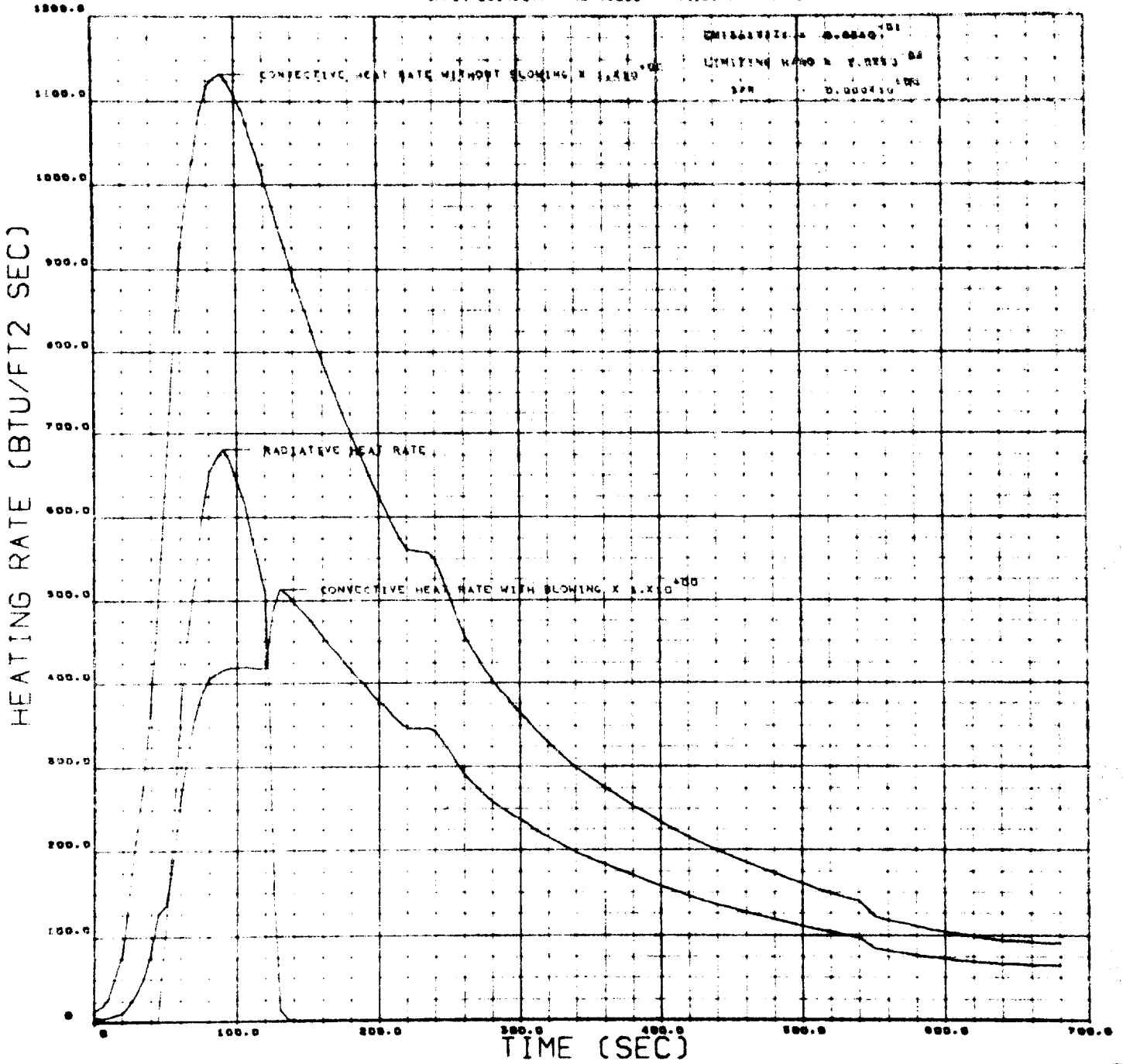


FIGURE B.35

MATERIAL RESPONSE DATA

UPPER BOUNDARY - VE:45000 - TRAJECTORY US-45 AND US-47

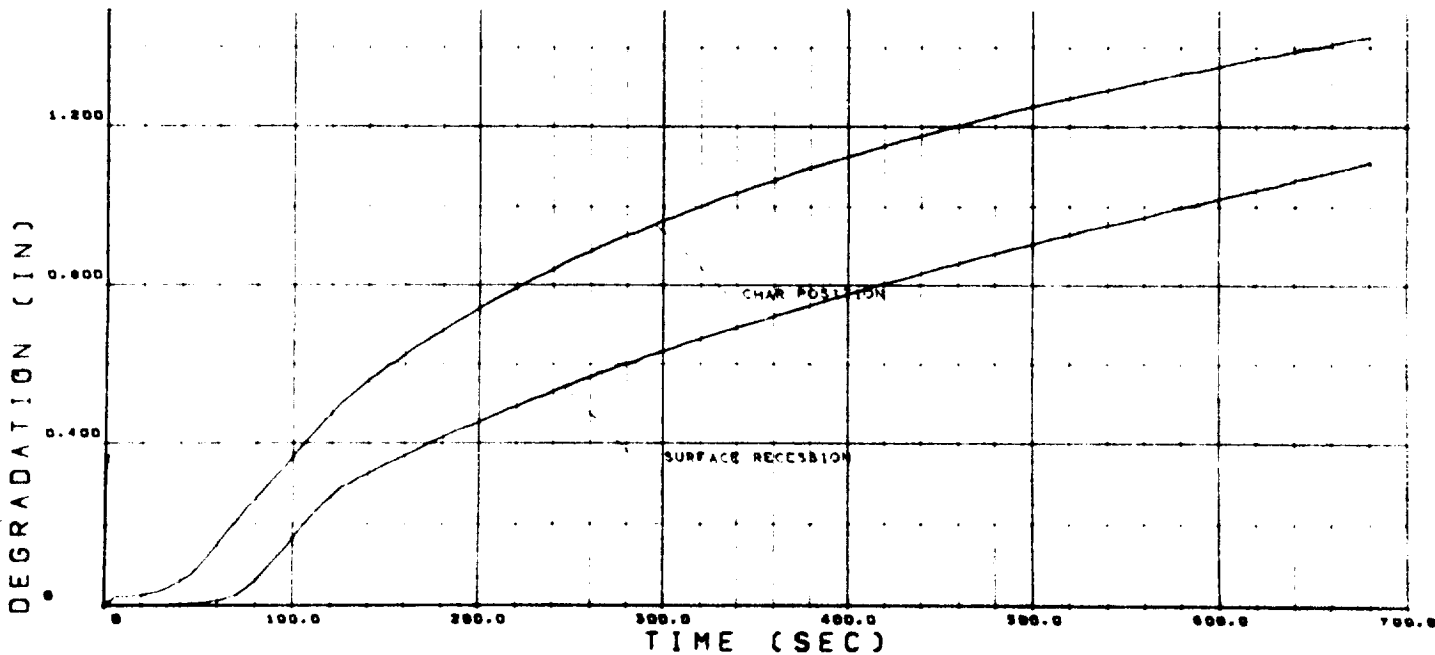
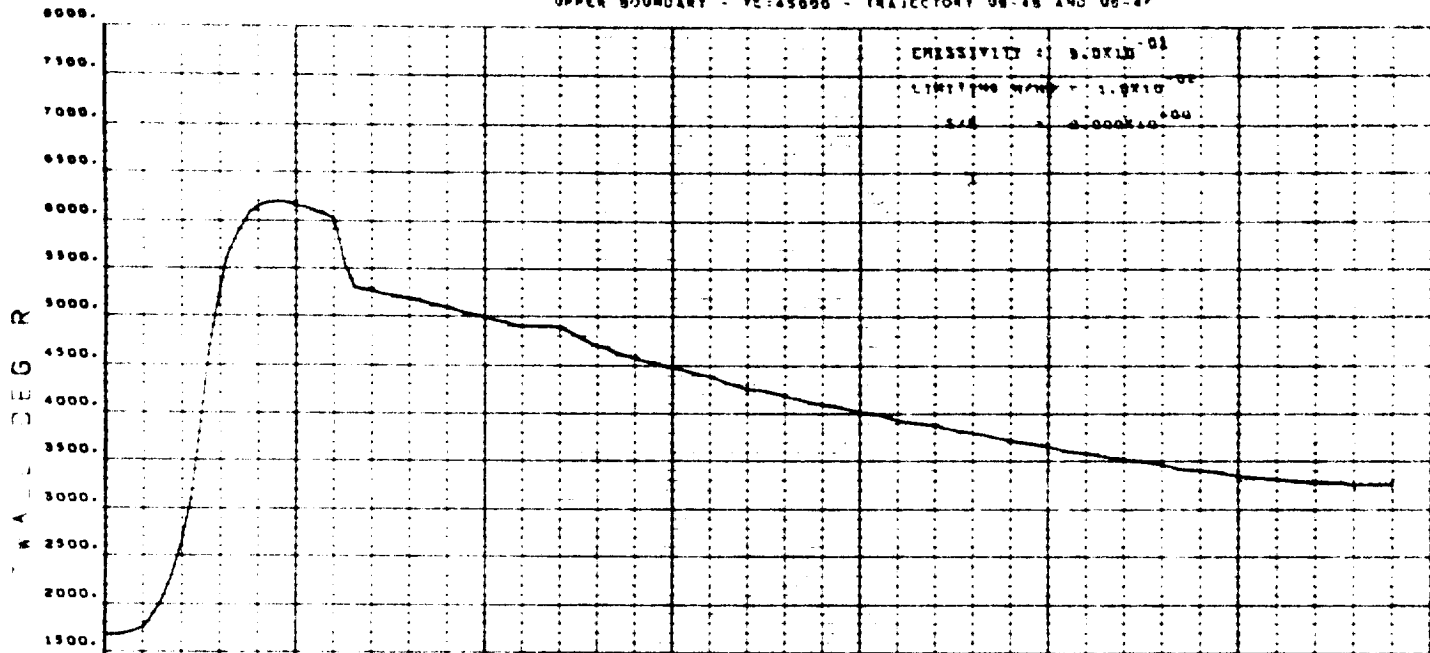


FIGURE B35

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - 75.4500 - TRAJECTORY US-48 AND US-47

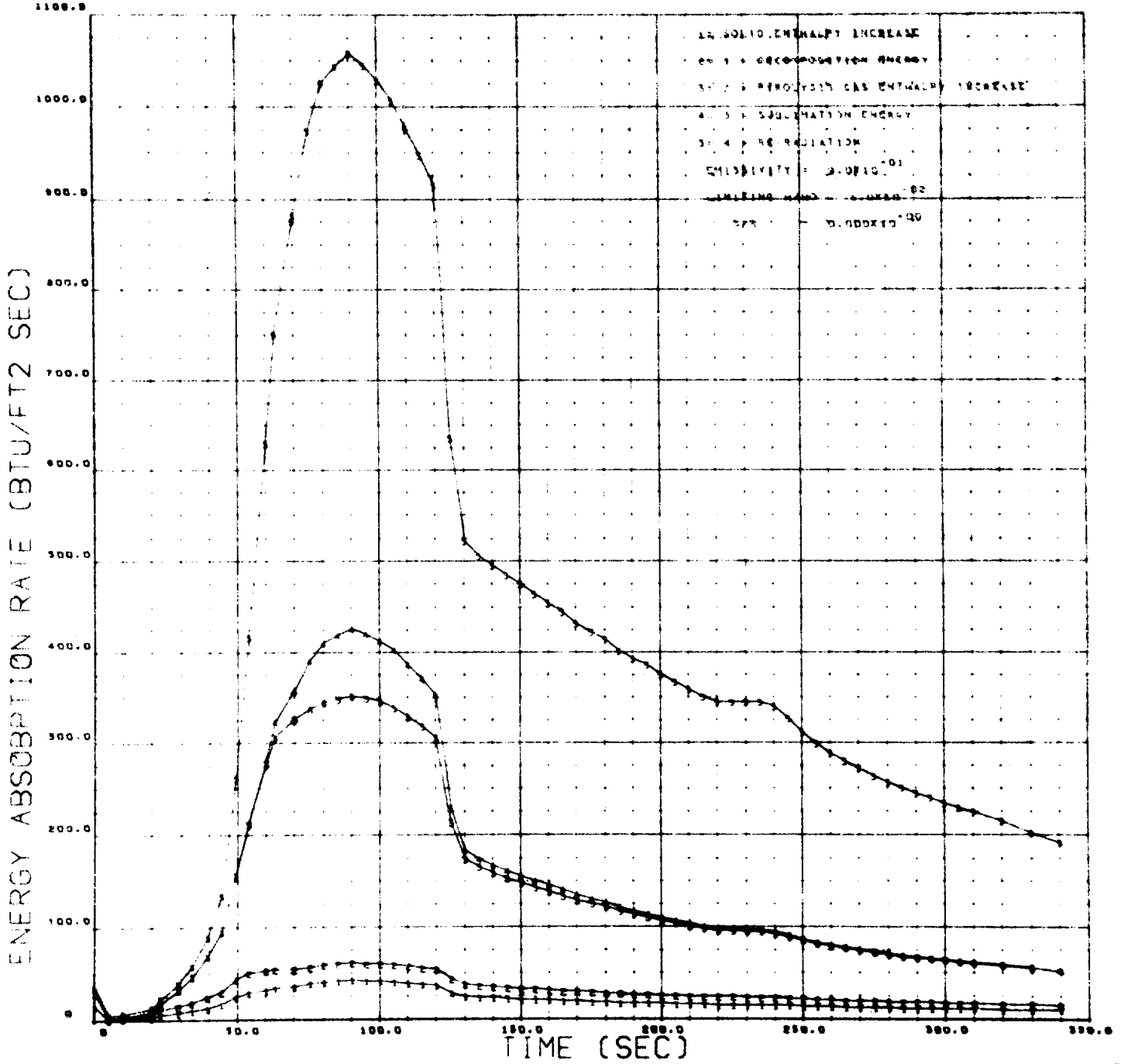


FIGURE B56

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VE=45000 - TRAJECTORY US-48 END US-47

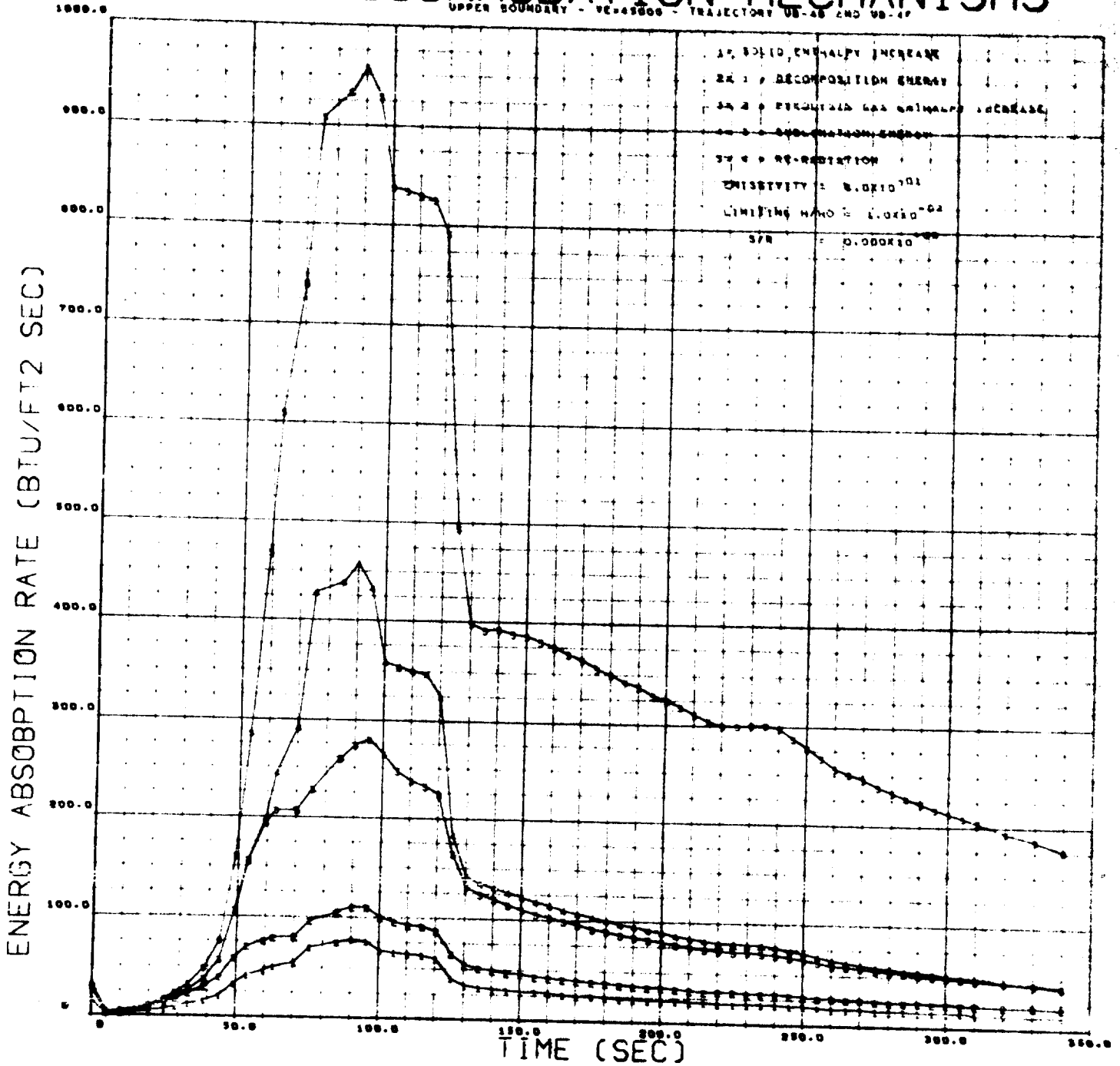


FIGURE 836

HEATING RATE HISTORY

UPPER BOUNDARY - VE=49000 - TRAJECTORY US-48 AND US-47

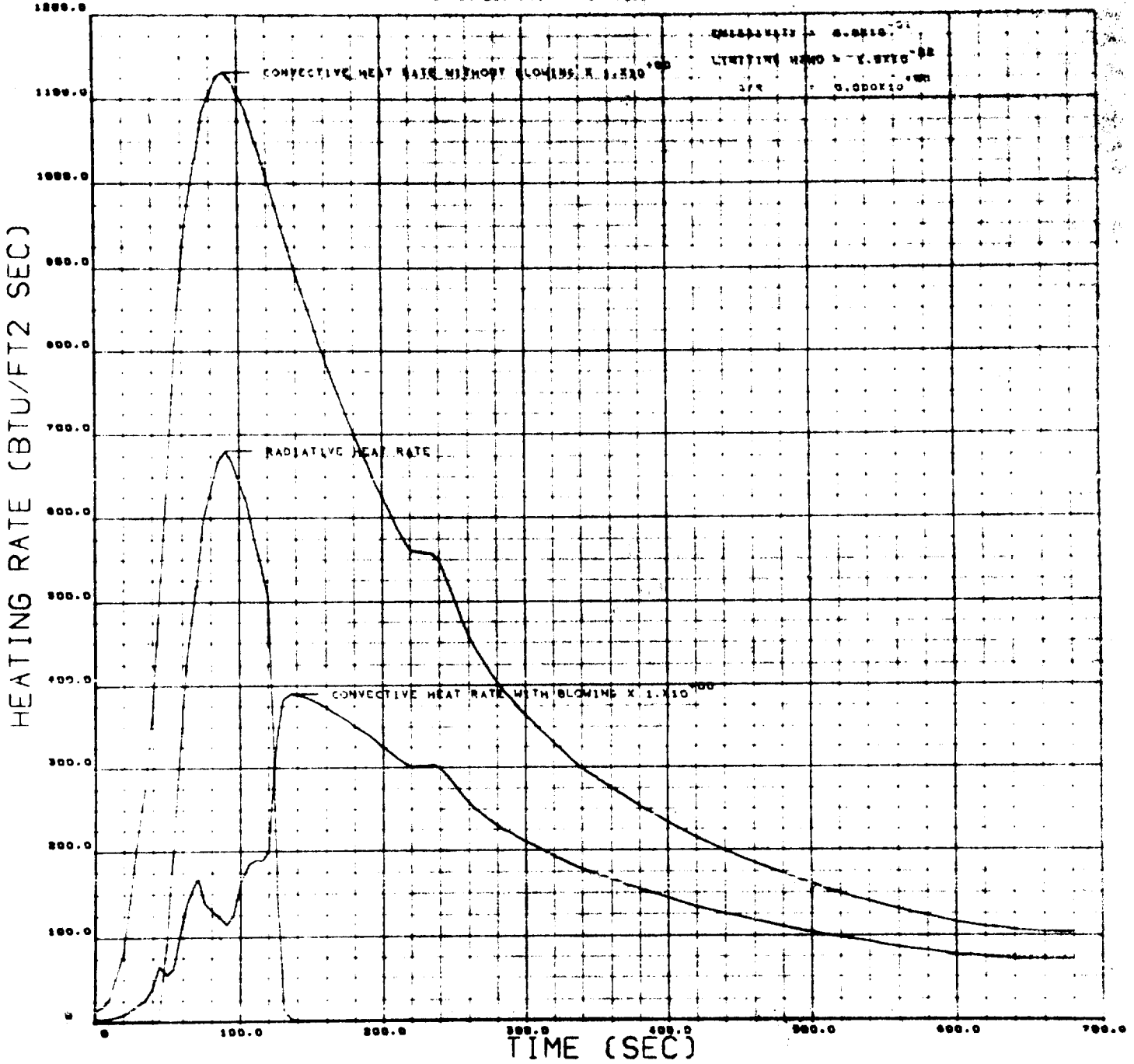
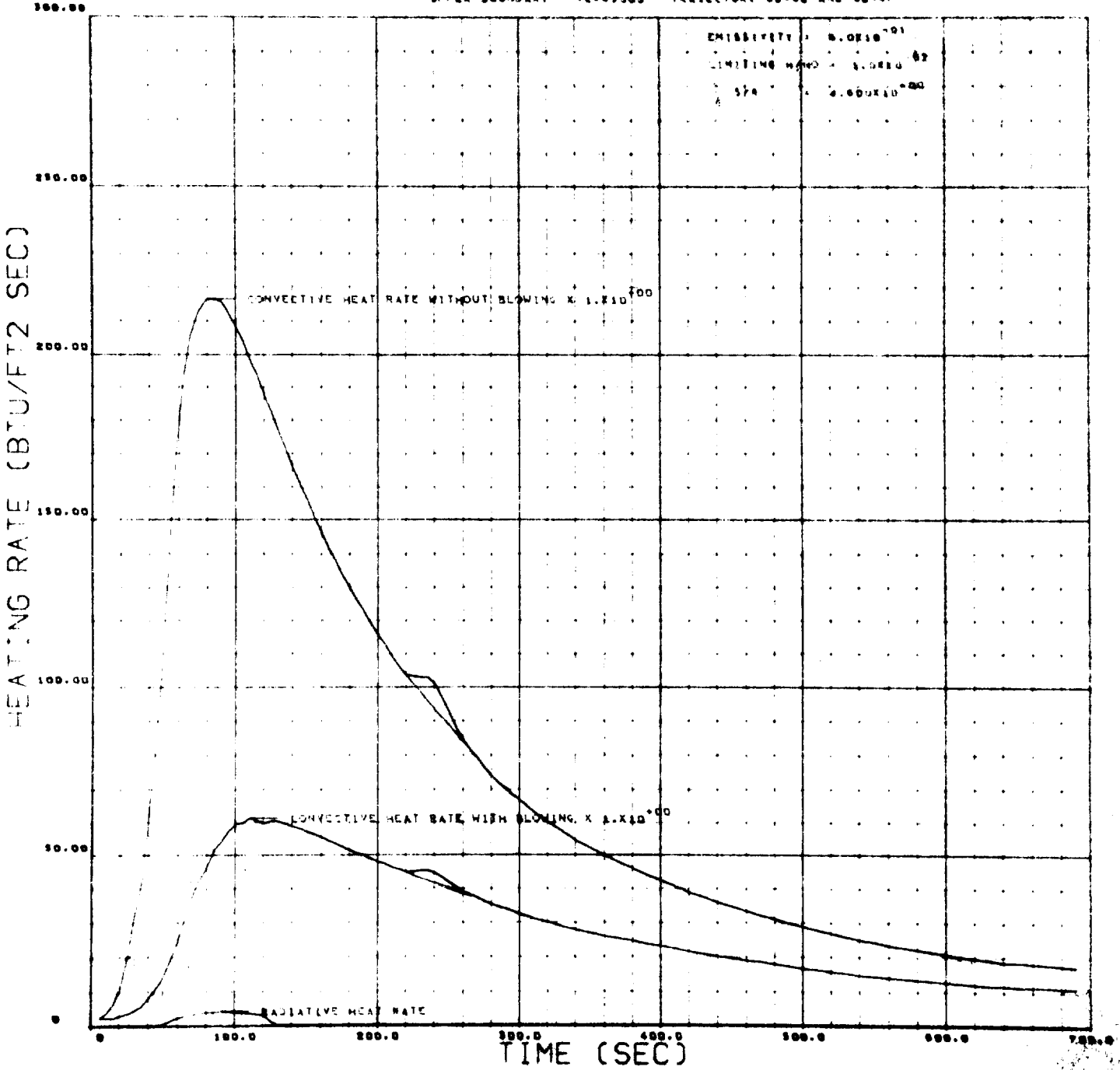


FIGURE 037

HEATING RATE HISTORY

UPPER BOUNDARY - VE-49000 - TRAJECTORY US-48 AND US-47

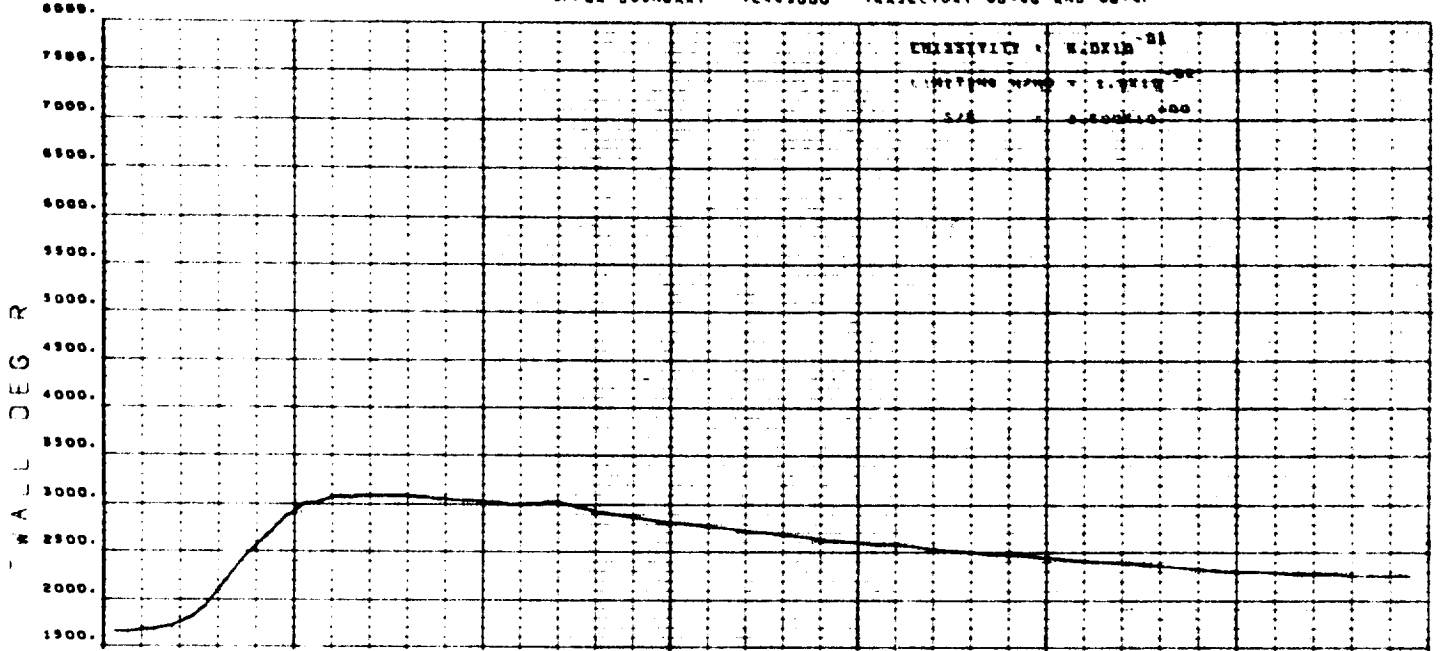


460

FIGURE B37

MATERIAL RESPONSE DATA

UPPER BOUNDARY - VE=45000 - TRAJECTORY US-65 AND US-67



CHARACTERISTICS: W. D. K. 12-21
1.17117 92
2.20010 200

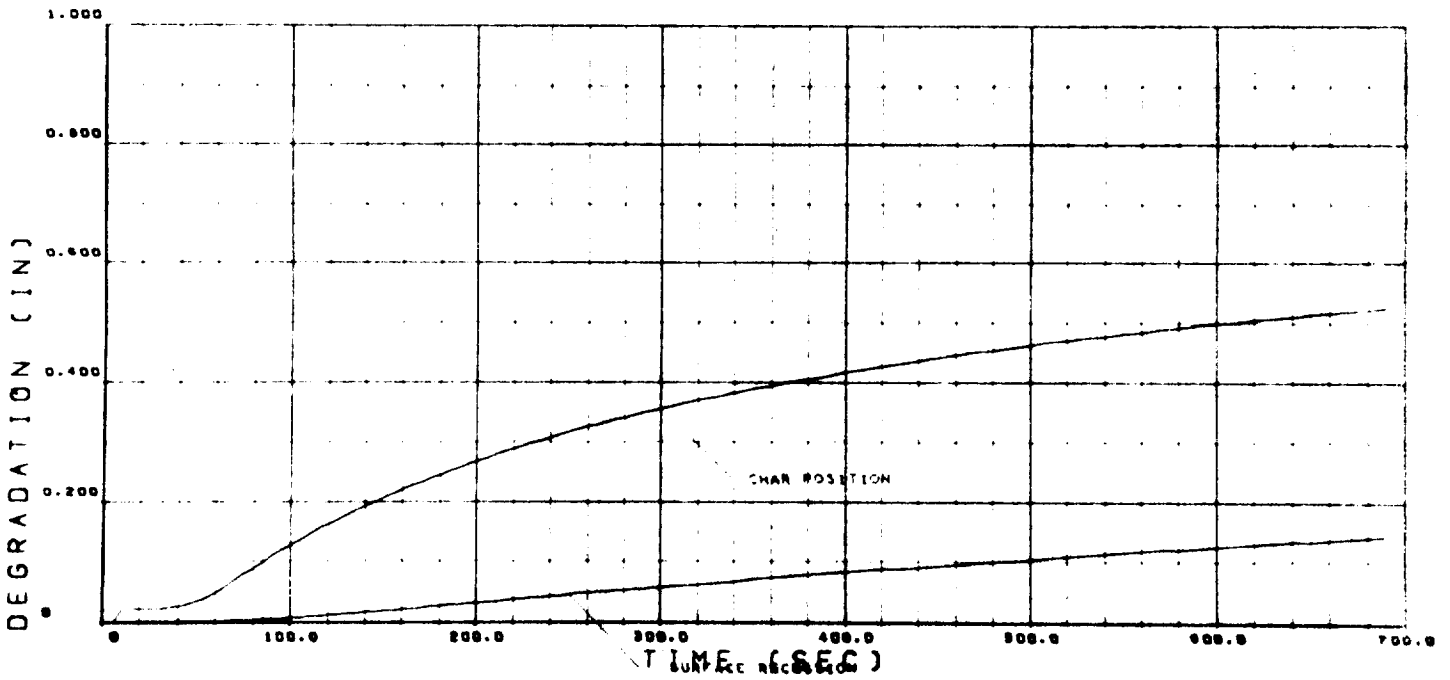


FIGURE B37

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY VE=15000 TRAJECTORY 08-40 AND 08-47

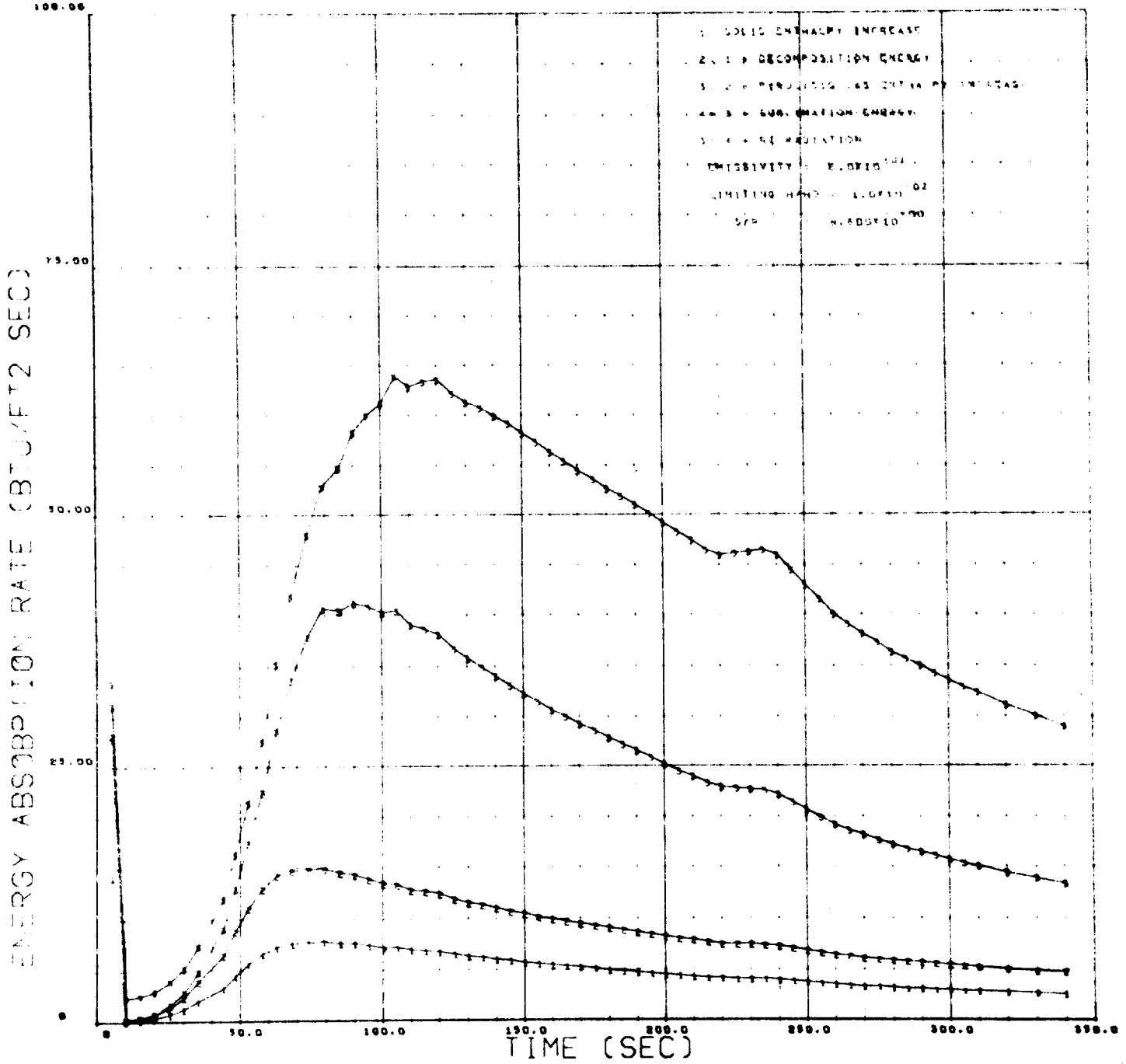


FIGURE B38

HEATING RATE HISTORY

UPPER BOUNDARY - FC:45000 - TRAJECTORY UB-45 AND UB-47

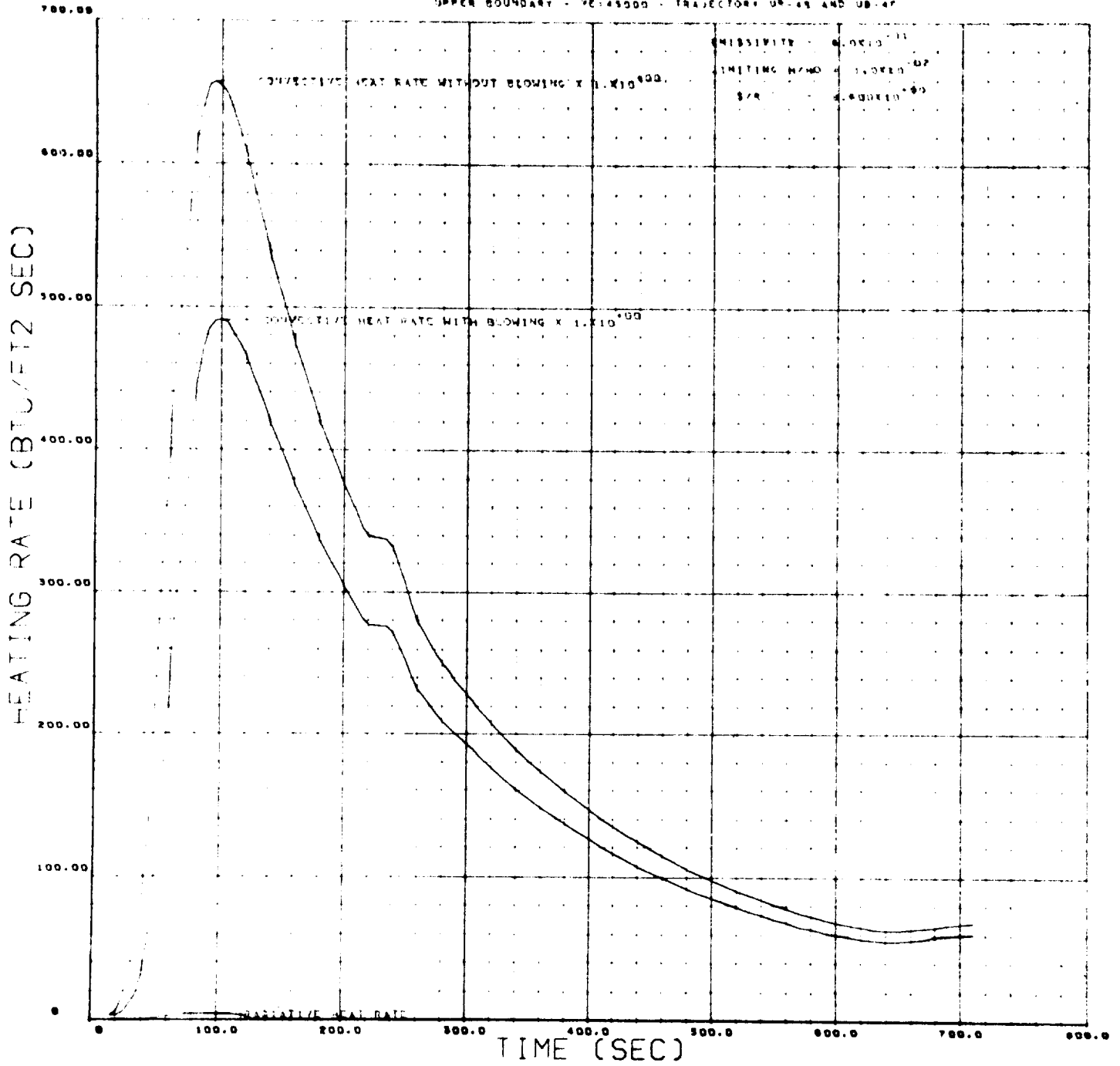


FIGURE B38

MATERIAL RESPONSE DATA

UPPER BOUNDARY VE-43000 TRAJECTORY US-48 AND US-47

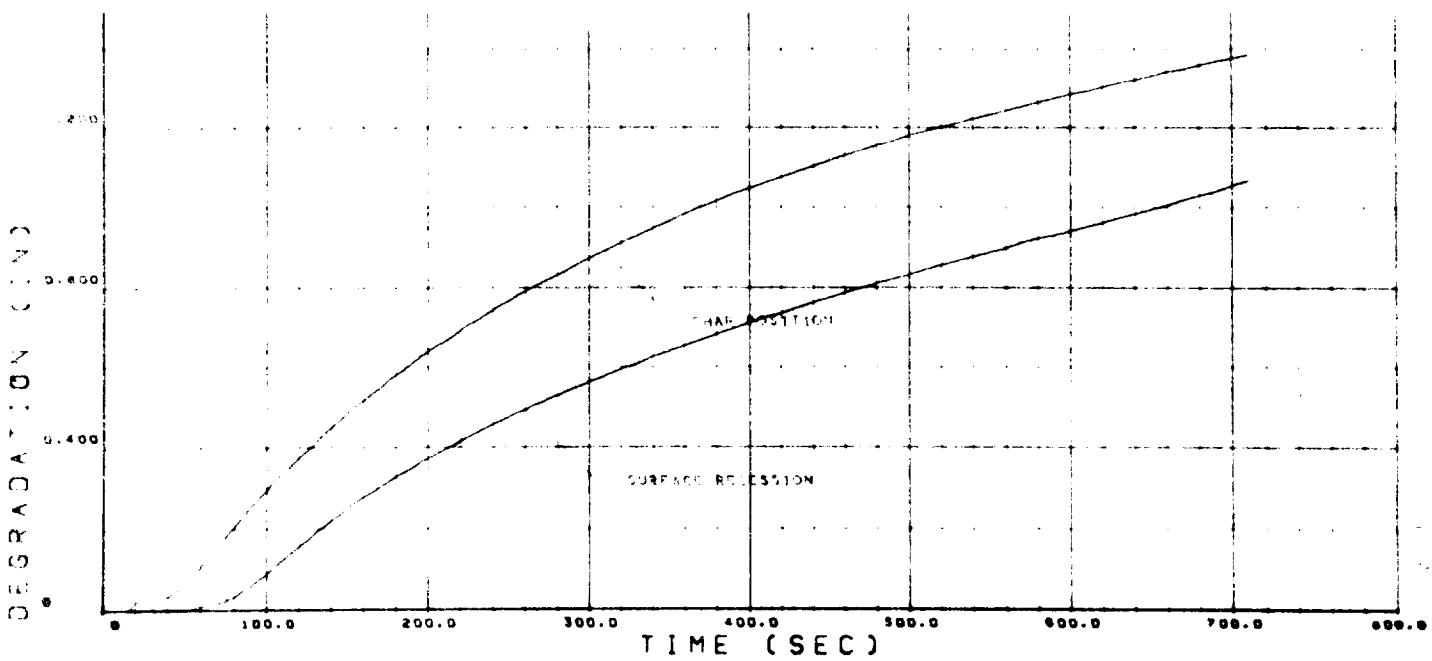
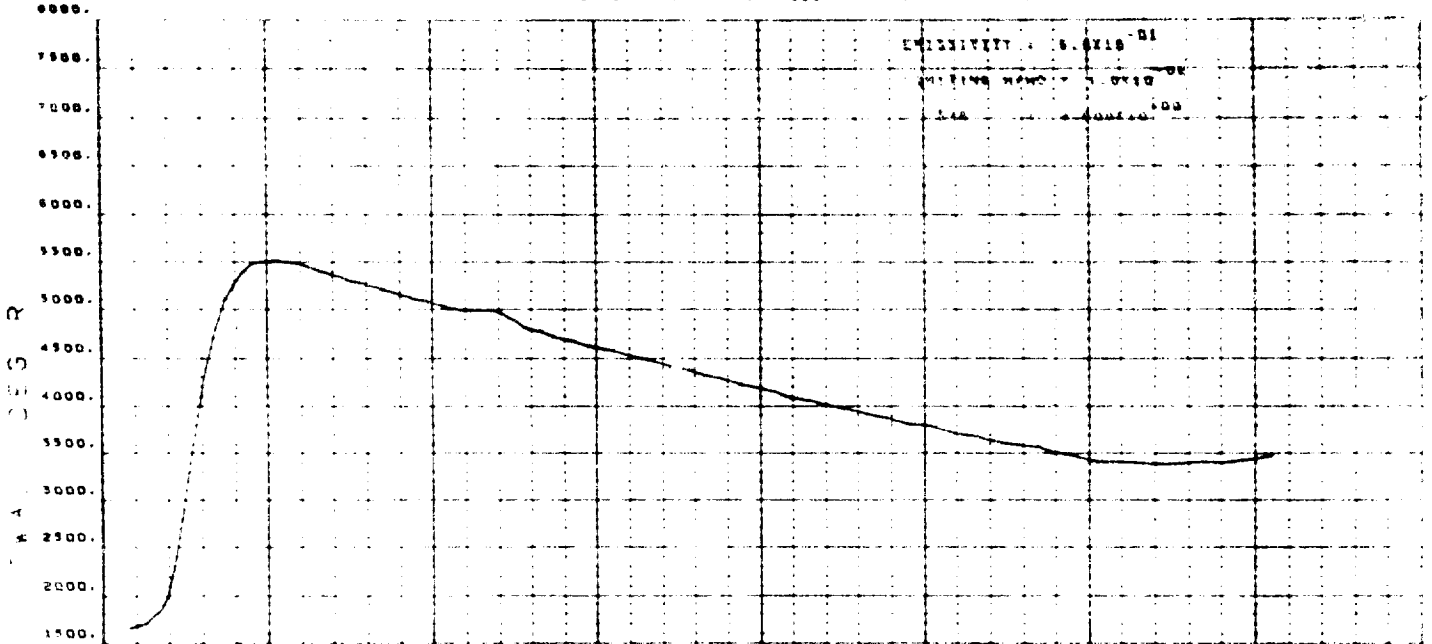


FIGURE B38

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VE=4500 - TRAJECTORY UB-48 AND UB-47

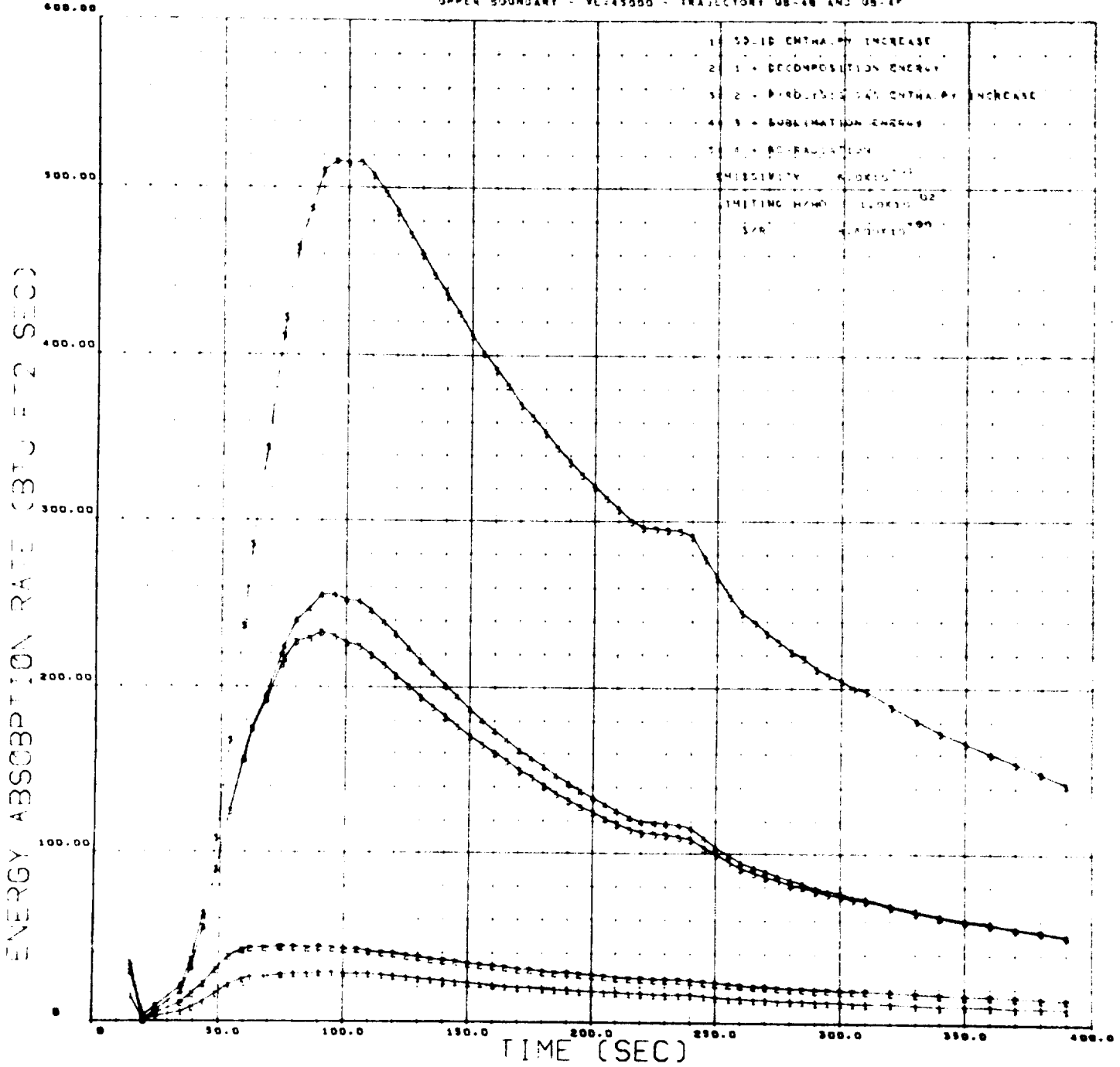


FIGURE B39

HEATING RATE HISTORY

UPPER BOUNDARY - VE=45000 - TRAJECTORY UB-48 AND UB-47

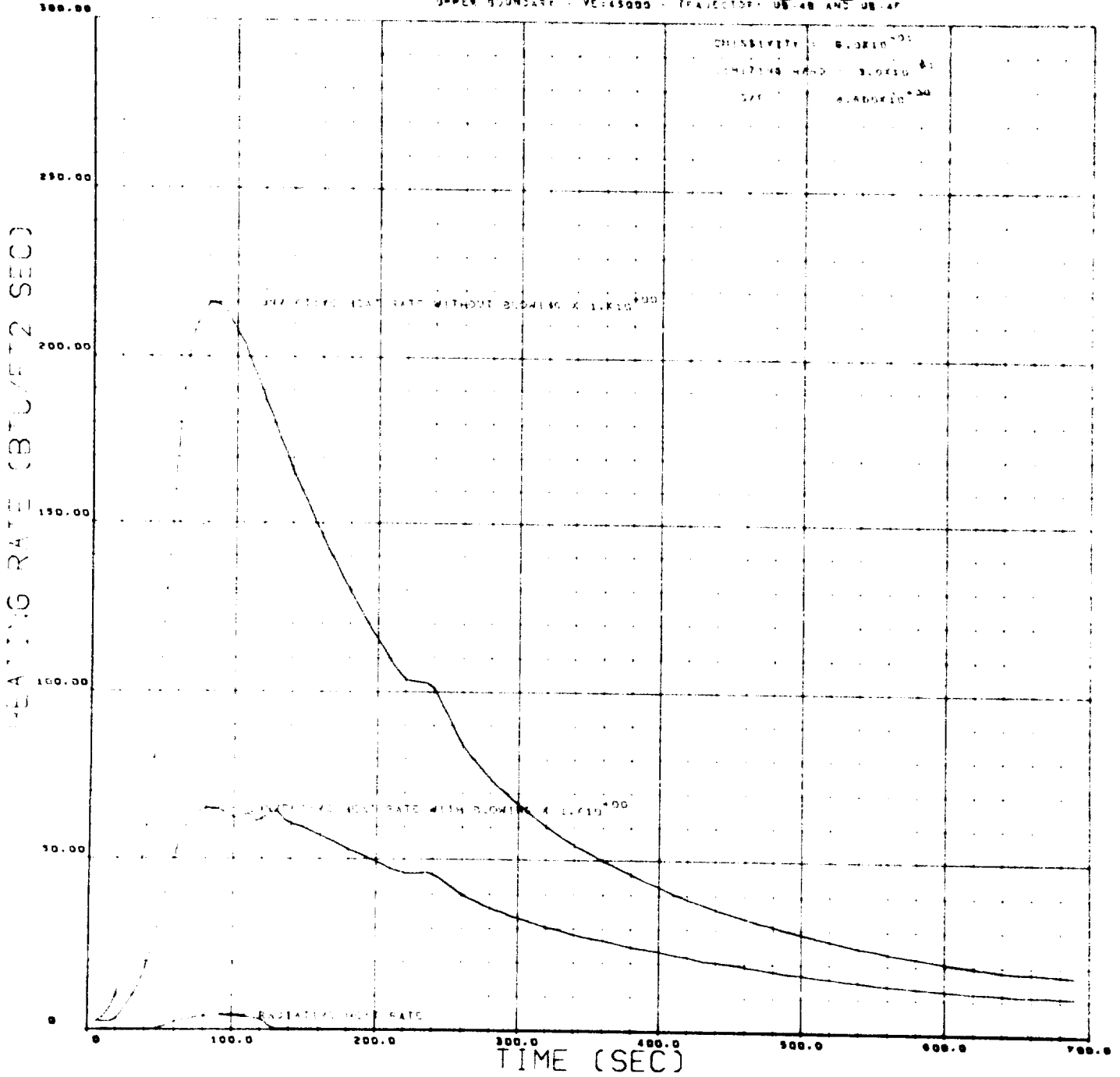


FIGURE B39

MATERIAL RESPONSE DATA

UPPER BOUNDARY - VE=45000 - TRAJECTORY 06 48 AND 06 49

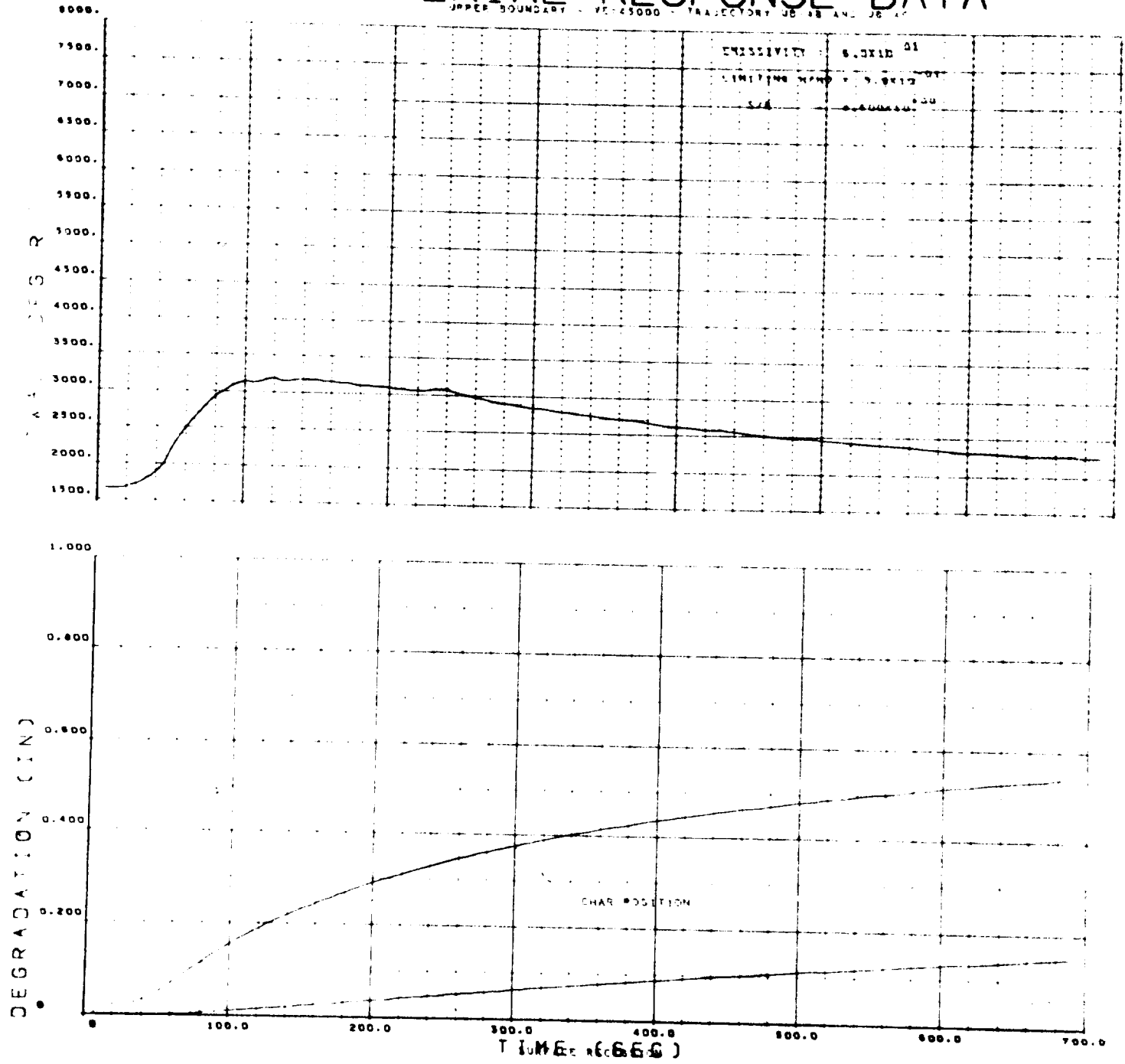


FIGURE B39

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - 1064500 - TRAJECTORY UB-48 AND UB-47

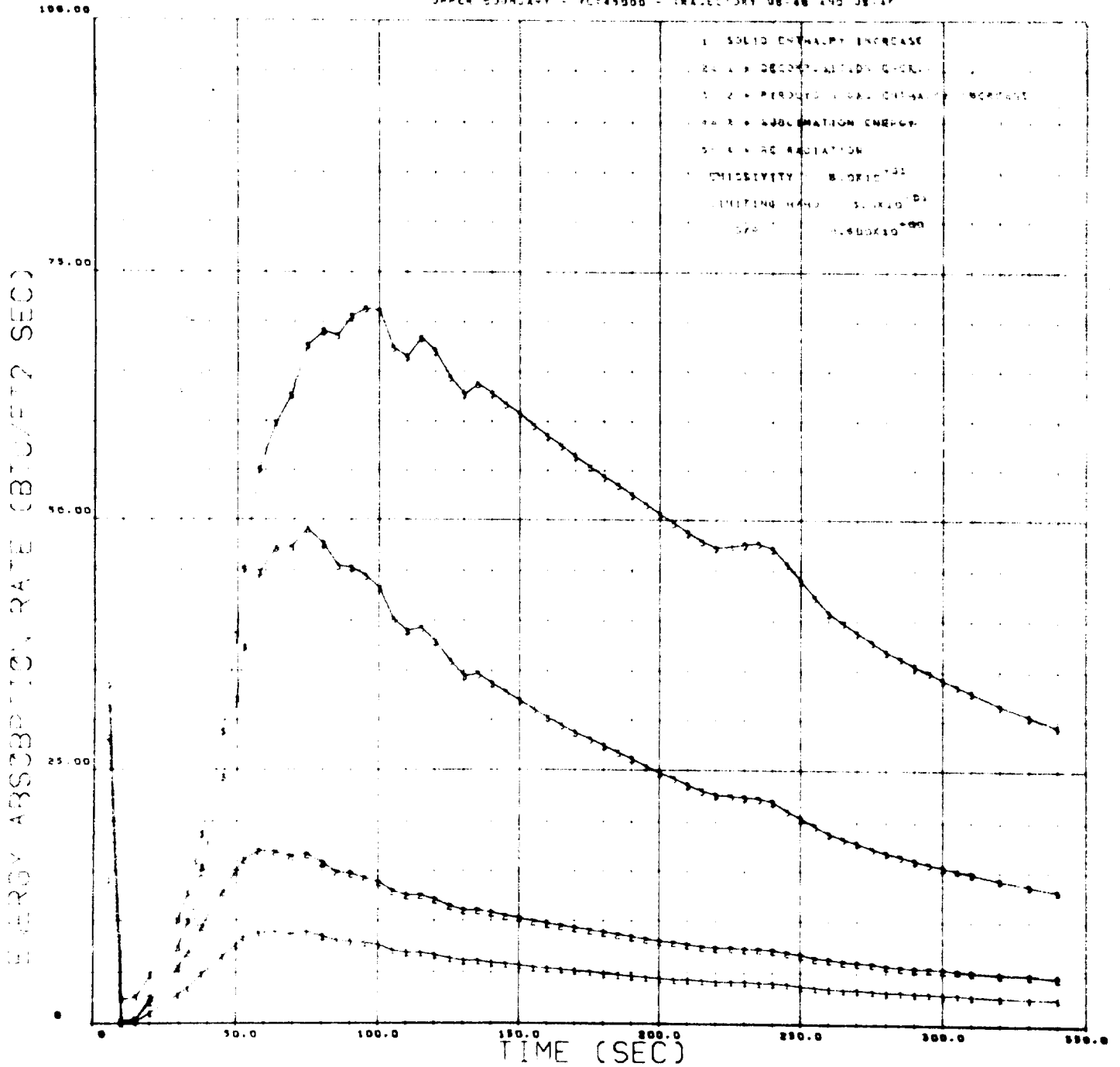


FIGURE B40

HEATING RATE HISTORY

UPPER BOUNDARY - YC-45000 - TRAJECTORY UB-4B AND UB-4F

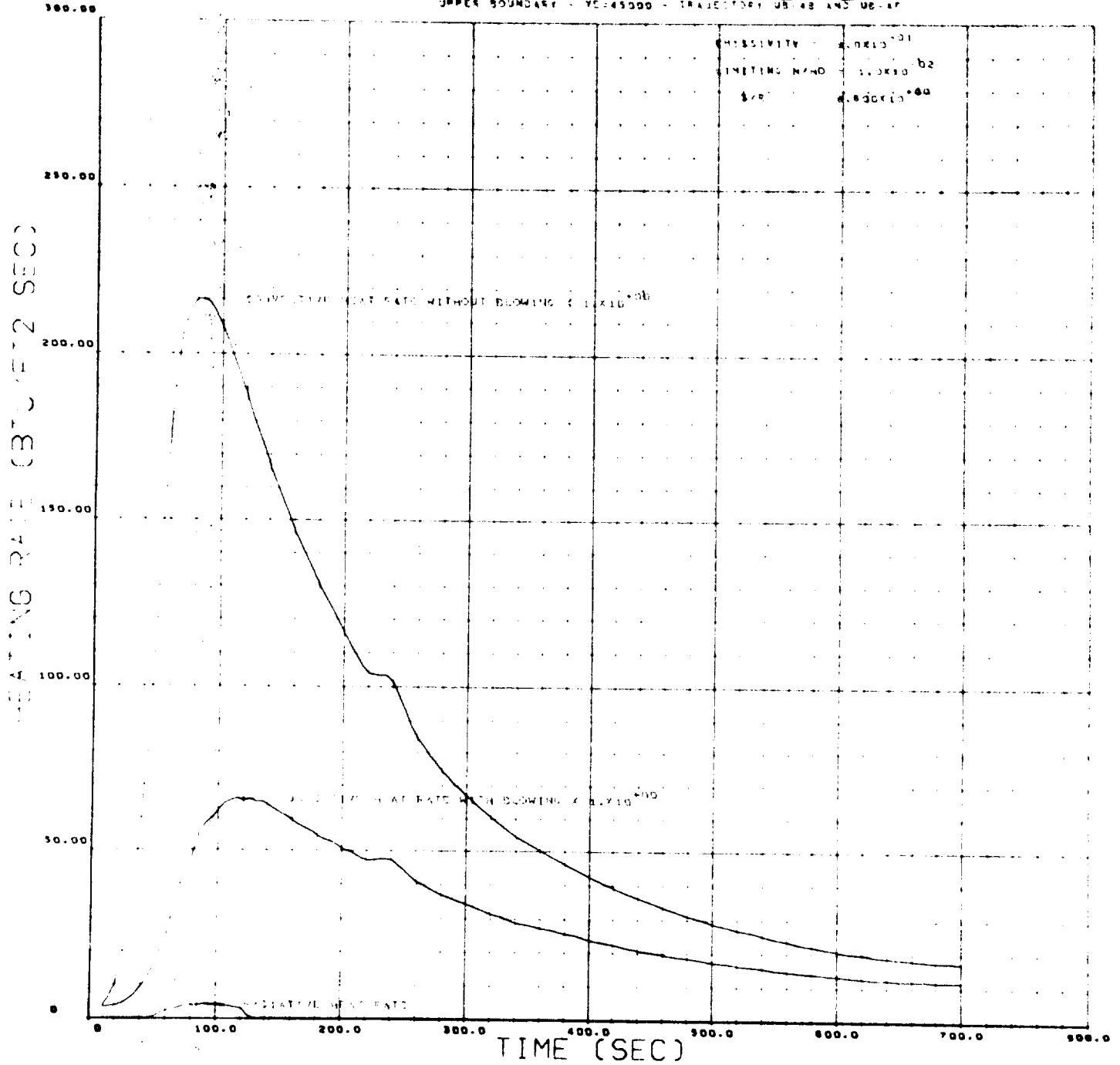


FIGURE 840

MATERIAL RESPONSE DATA

UPPER BOUNDARY 45-4500 TRAJECTORY 05-45 AND 08-47

EMISSIVITY = 0.8410 01
UNITED STATES NAVY
1960

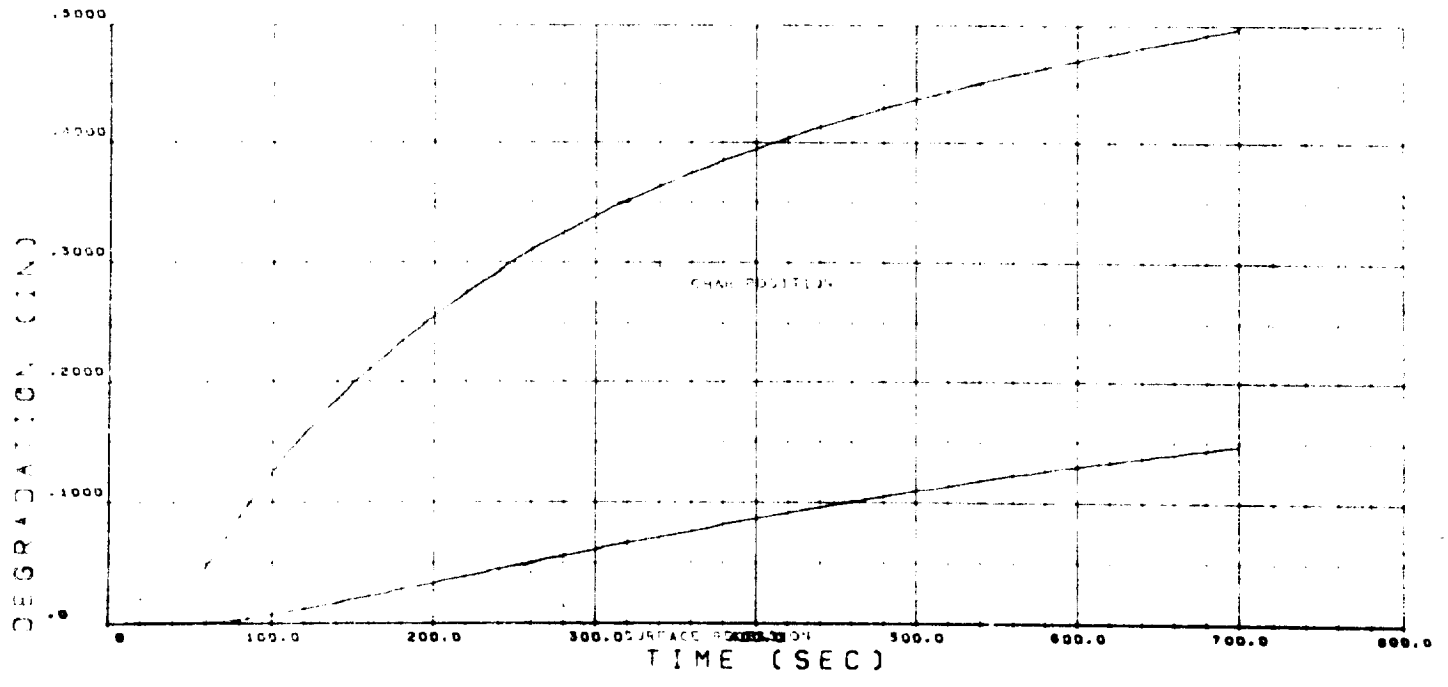
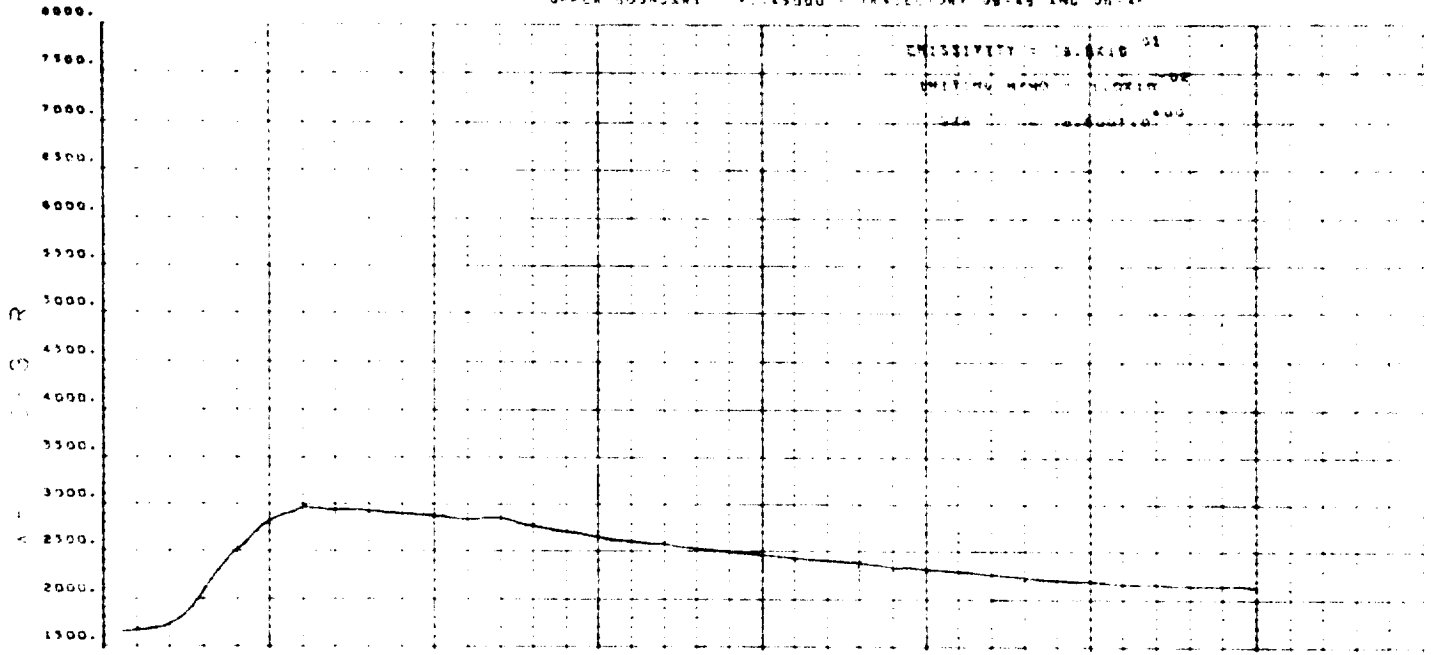


FIGURE B40

ENERGY ACCOMMODATION MECHANISMS

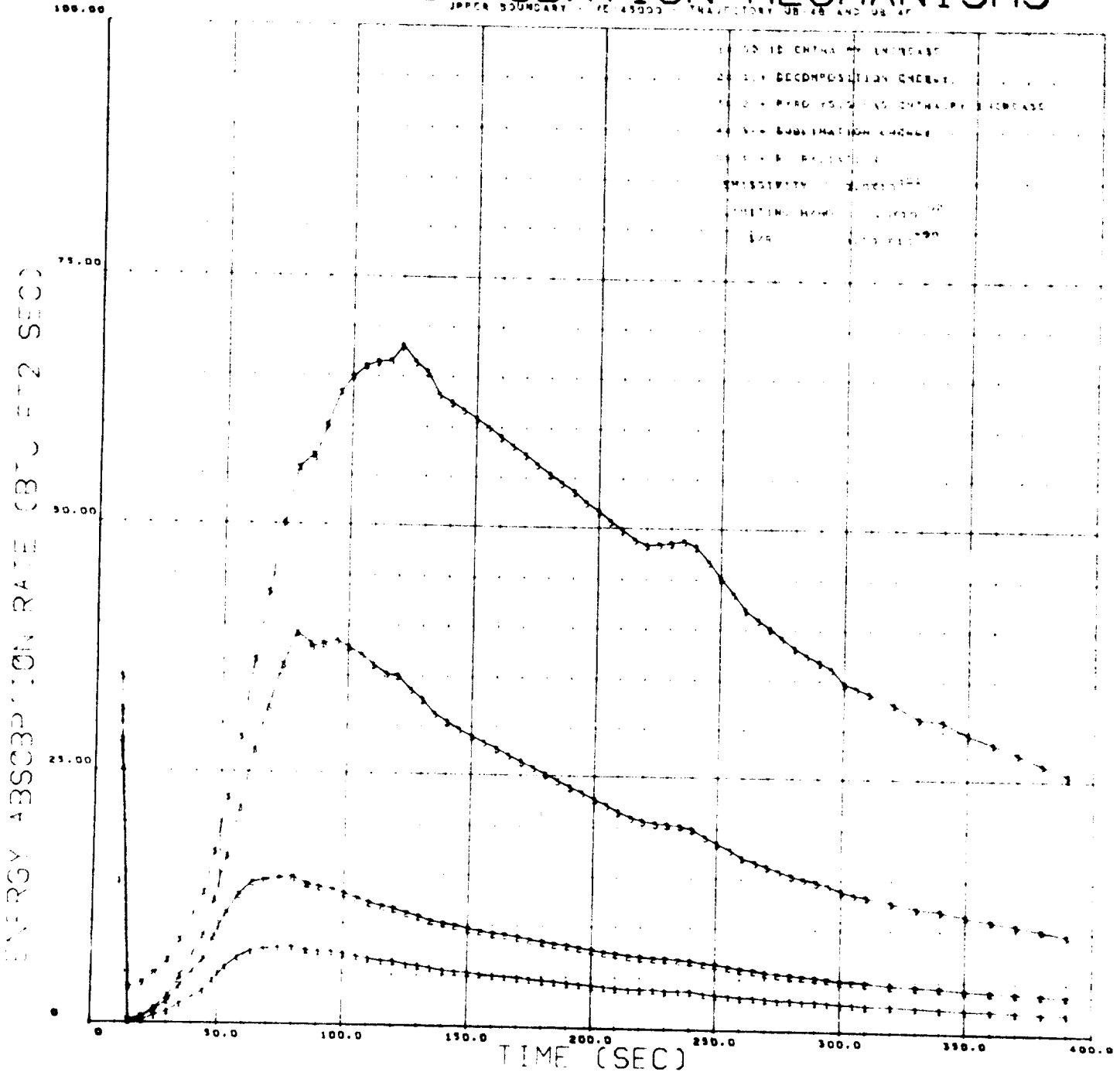


FIGURE B41

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VE=45000 - TRAJECTORY US-45 AND US-47

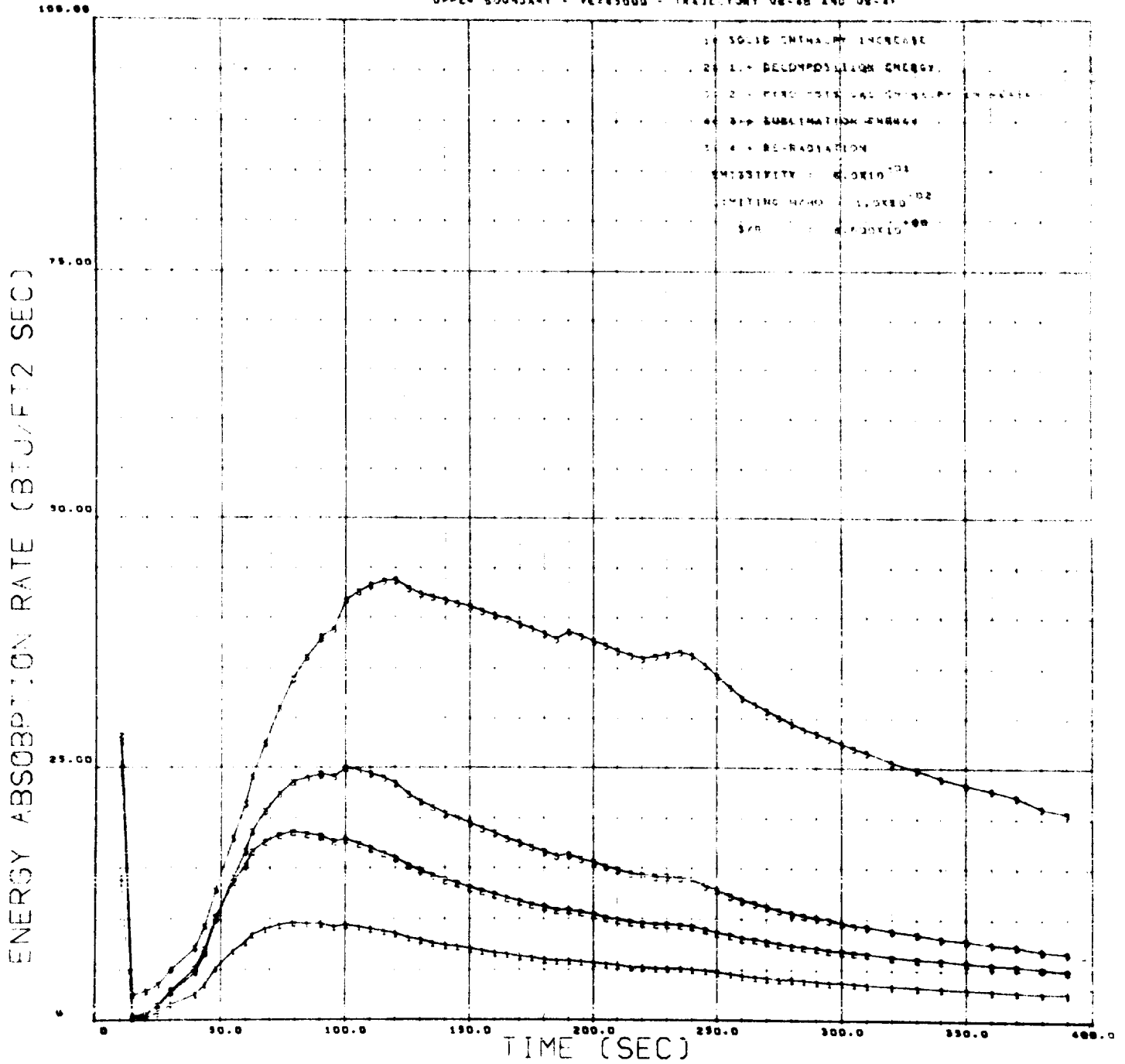


FIGURE B41

HEATING RATE HISTORY

UPPER BOUNDARY - VE=43000 - TRAJECTORY 00-40 AND 00-41

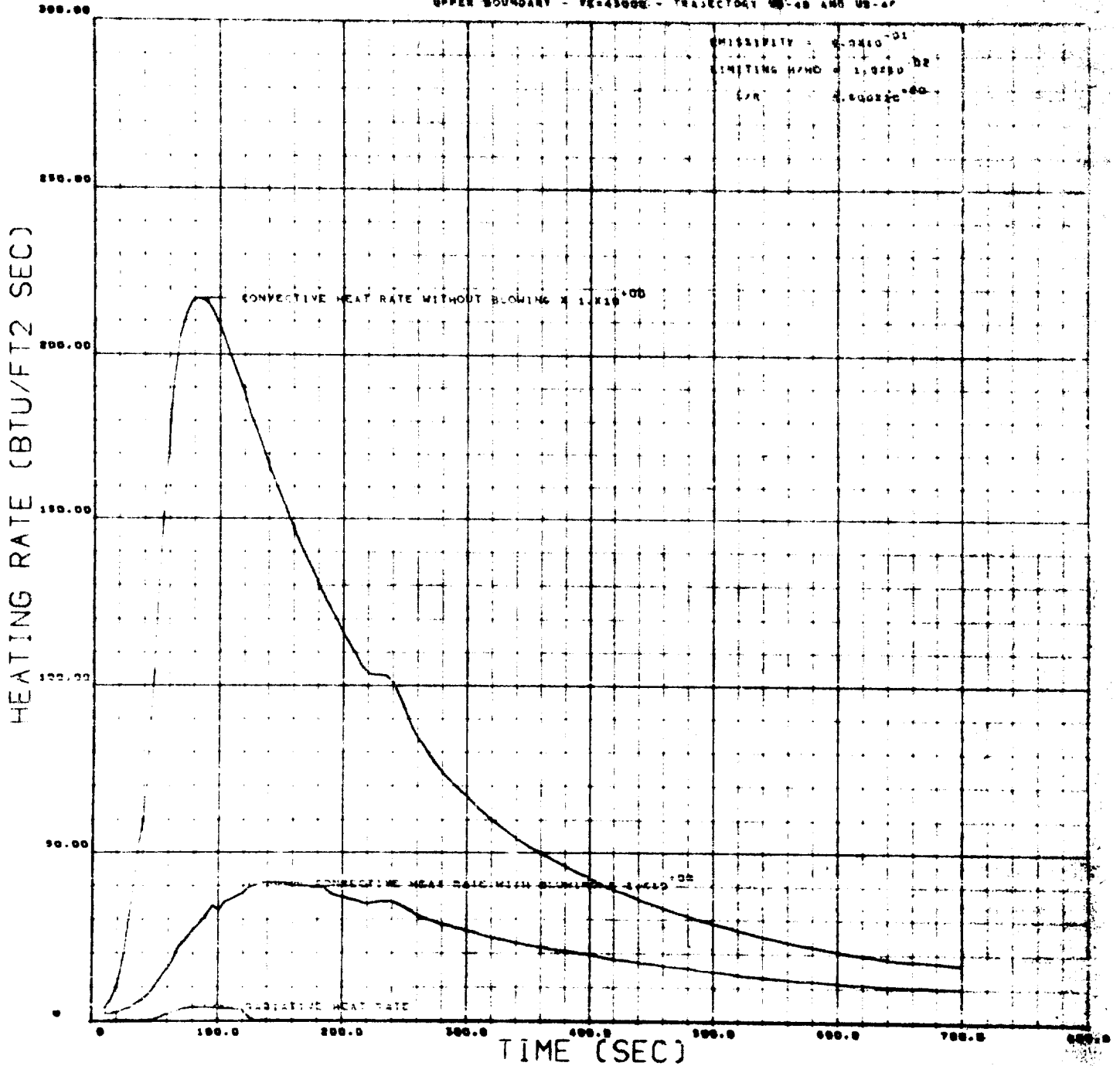


FIGURE B42

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VE-42800 - TRAJECTORY US-42 AND US-47

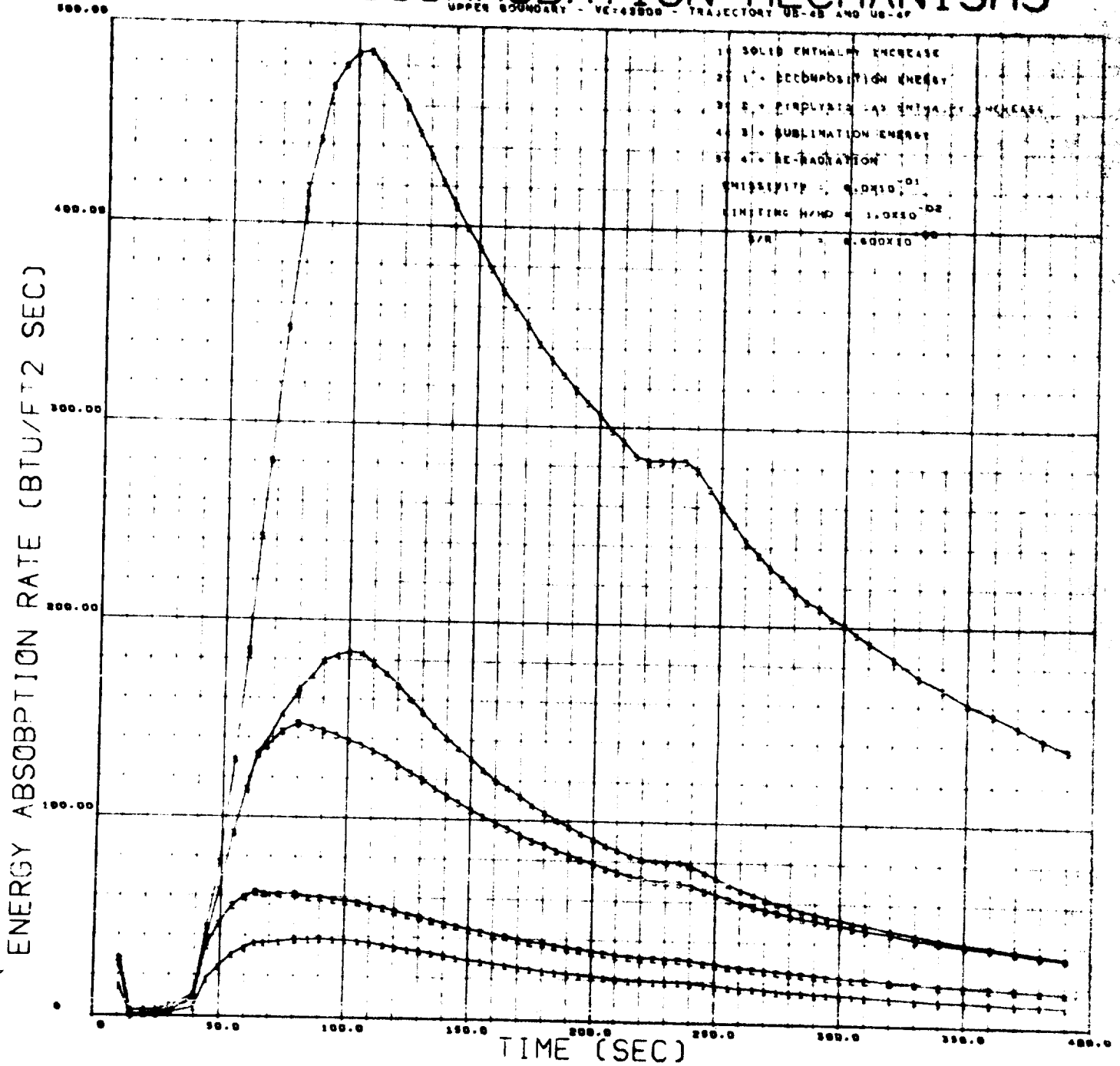


FIGURE 04R

MATERIAL RESPONSE DATA

UPPER BOUNDARY - VE=46000 - TRAJECTORY US-46 AND US-47

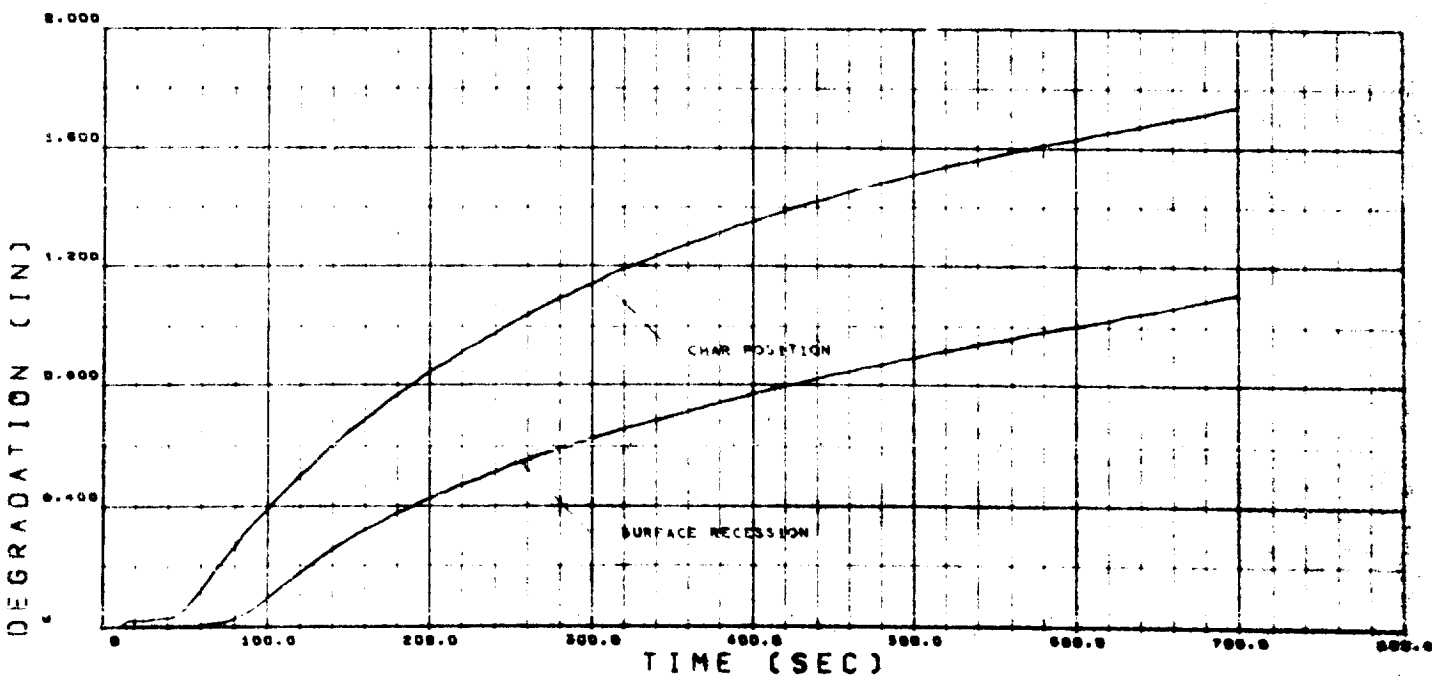
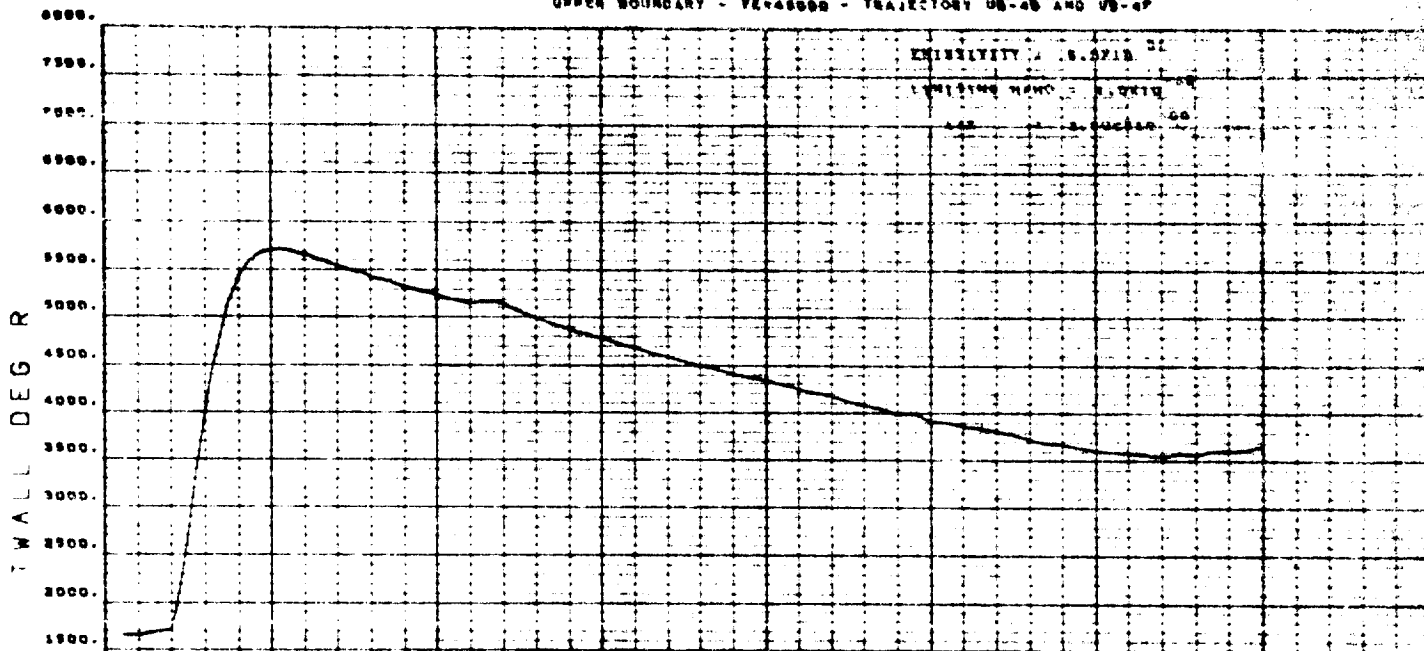


FIGURE 342

HEATING RATE HISTORY

UPPER BOUNDARY - VE=45000 - TRAJECTORY UB-45 AND UB-47

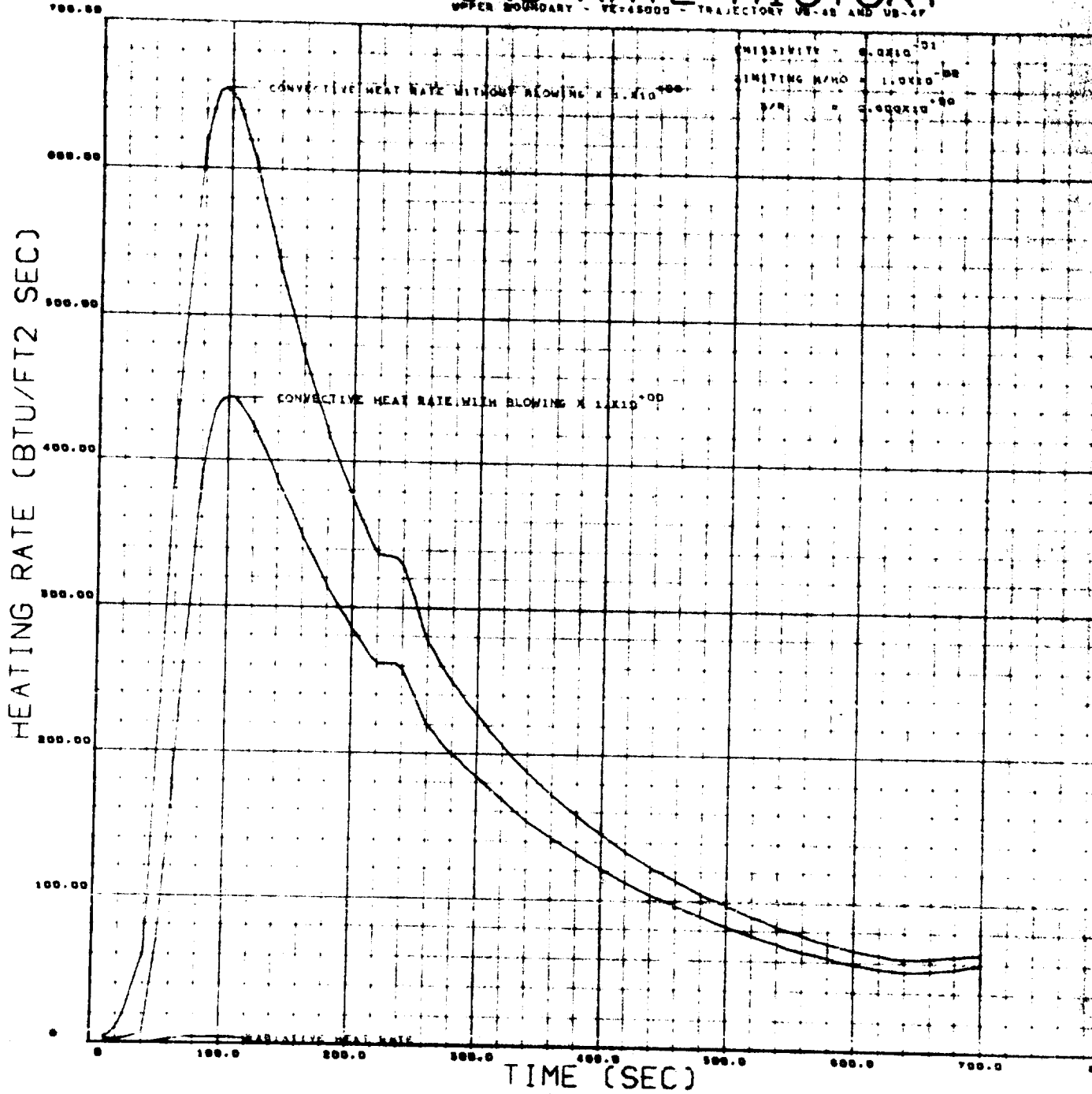


FIGURE B43

HEATING RATE HISTORY

UPPER BOUNDARY - VE=10000 TRAJECTORY 08-96 AND 08-97

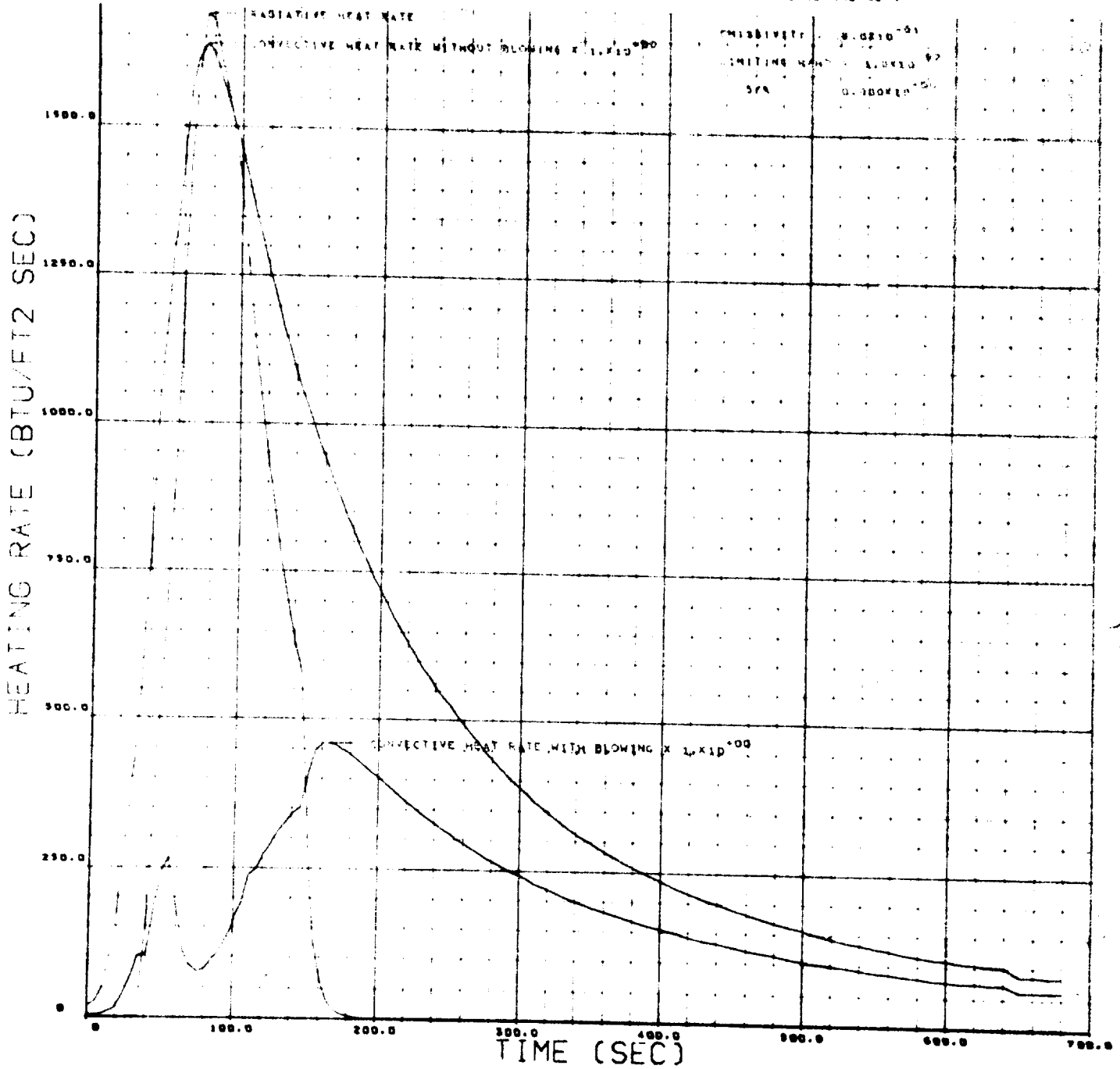


FIGURE B43

MATERIAL RESPONSE DATA

UPPER BOUNDARY - VE=50000 - TRAJECTORY UB-98 AND UB-97

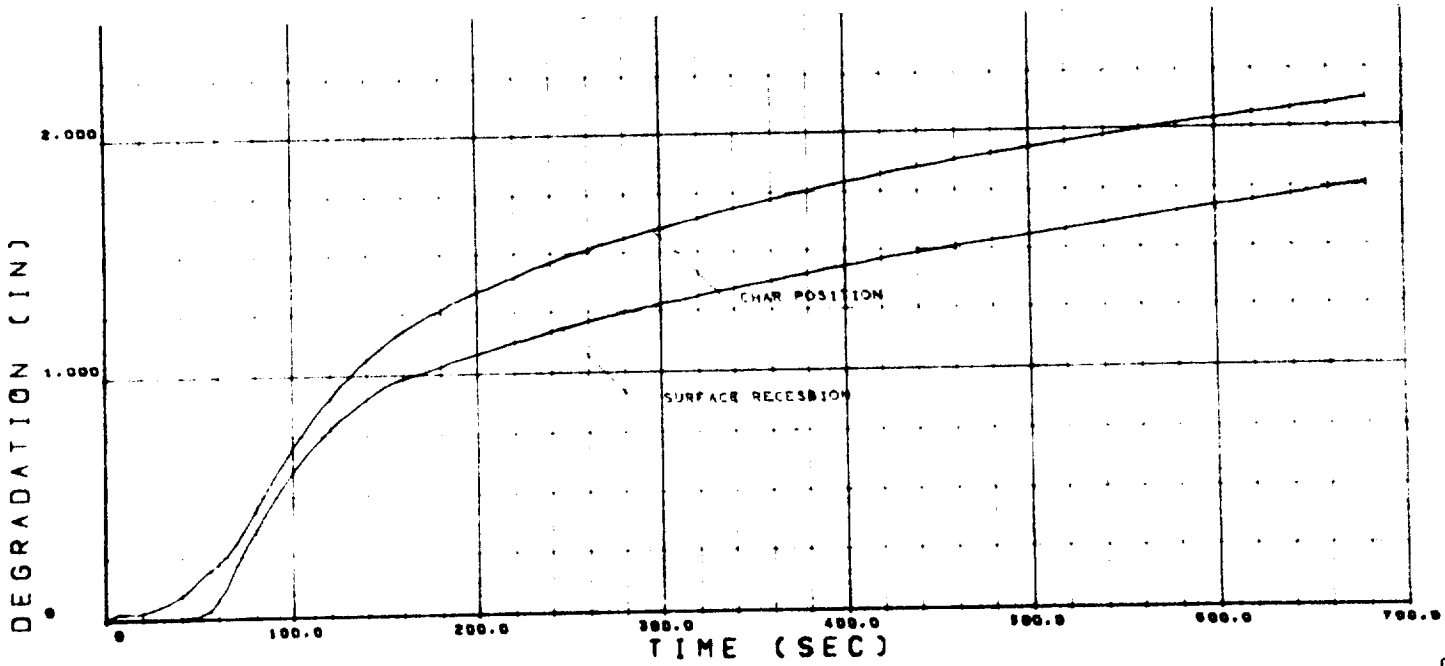
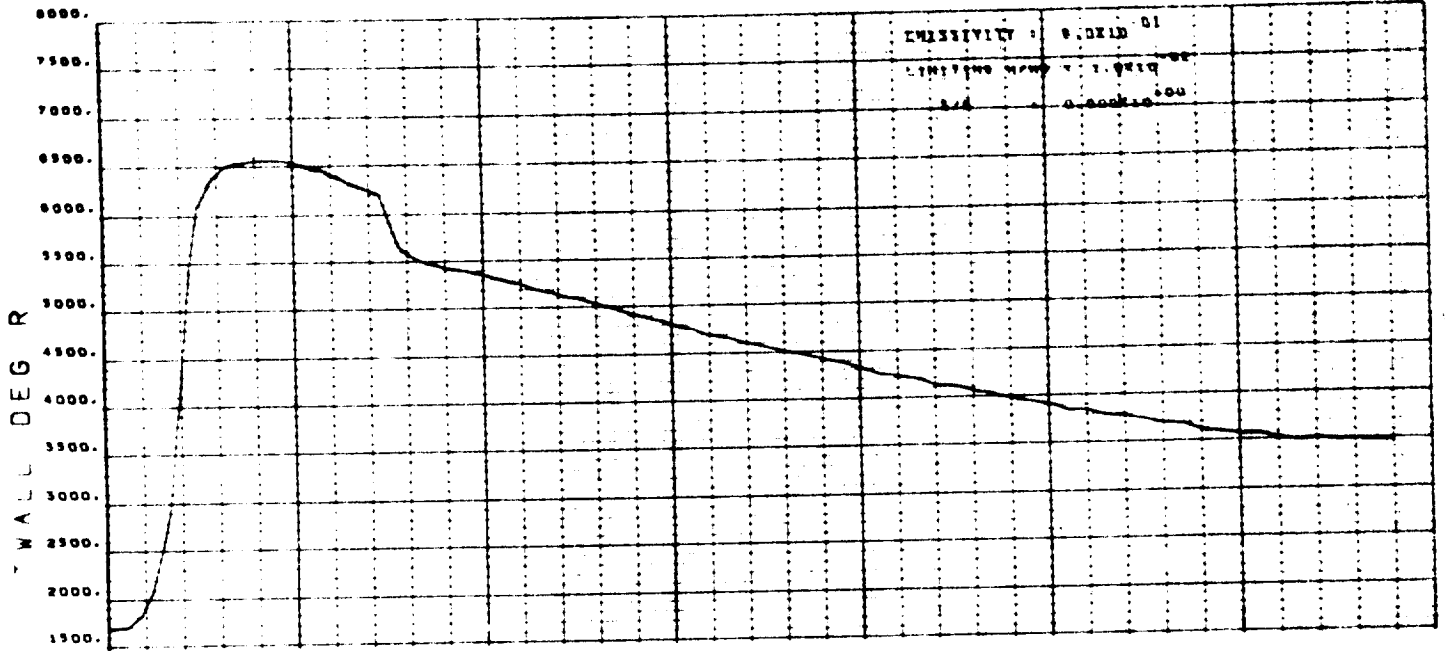


FIGURE B43

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VE=15000 - TRAJECTORY 98-38 AND 98-37

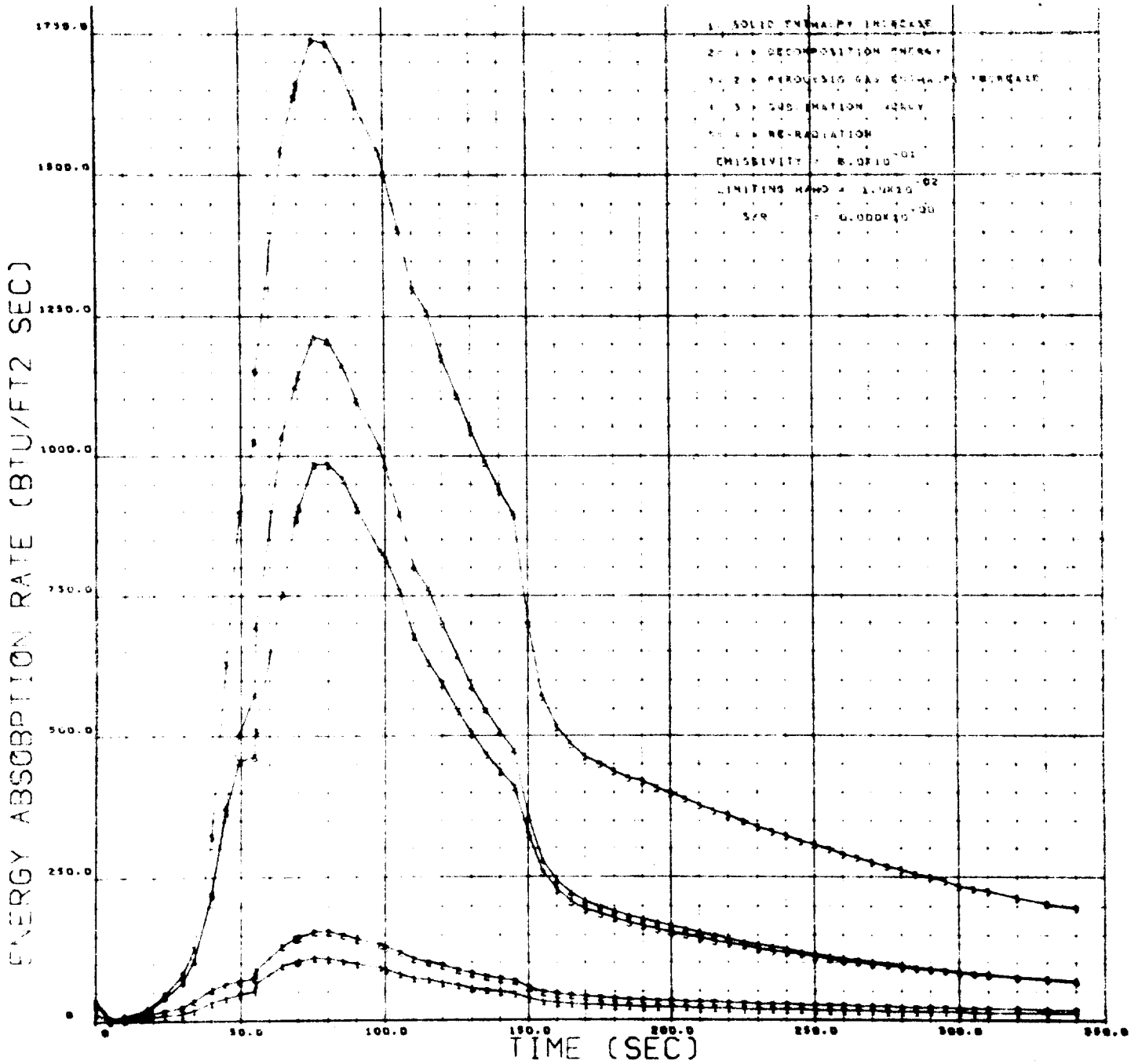


FIGURE B44

HEATING RATE HISTORY

UPPER BOUNDARY - VE-50000 - TRAJECTORY UB-50 AND UB-51

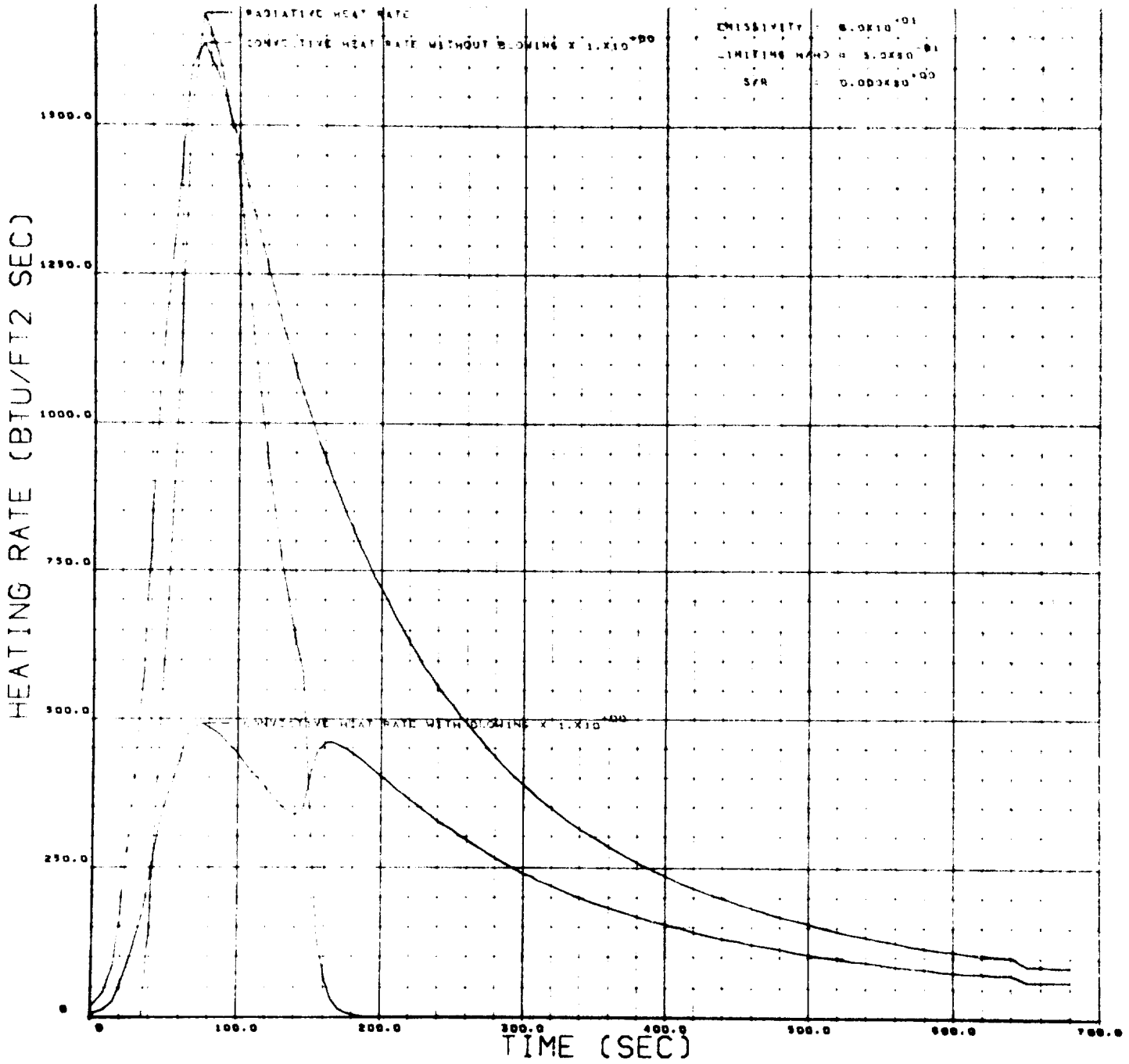


FIGURE B-11

MATERIAL RESPONSE DATA

UPPER BOUNDARY - VE=50000 - TRAJECTORY US-SP AND US-SP

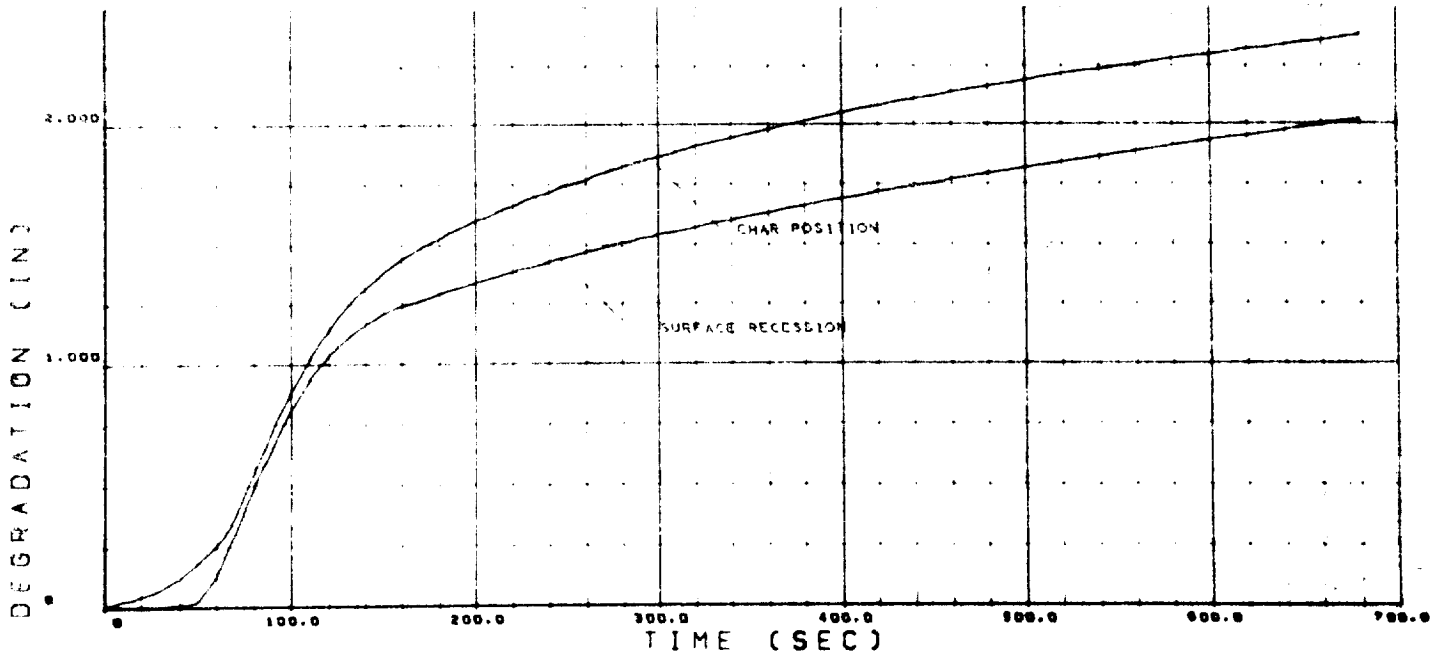
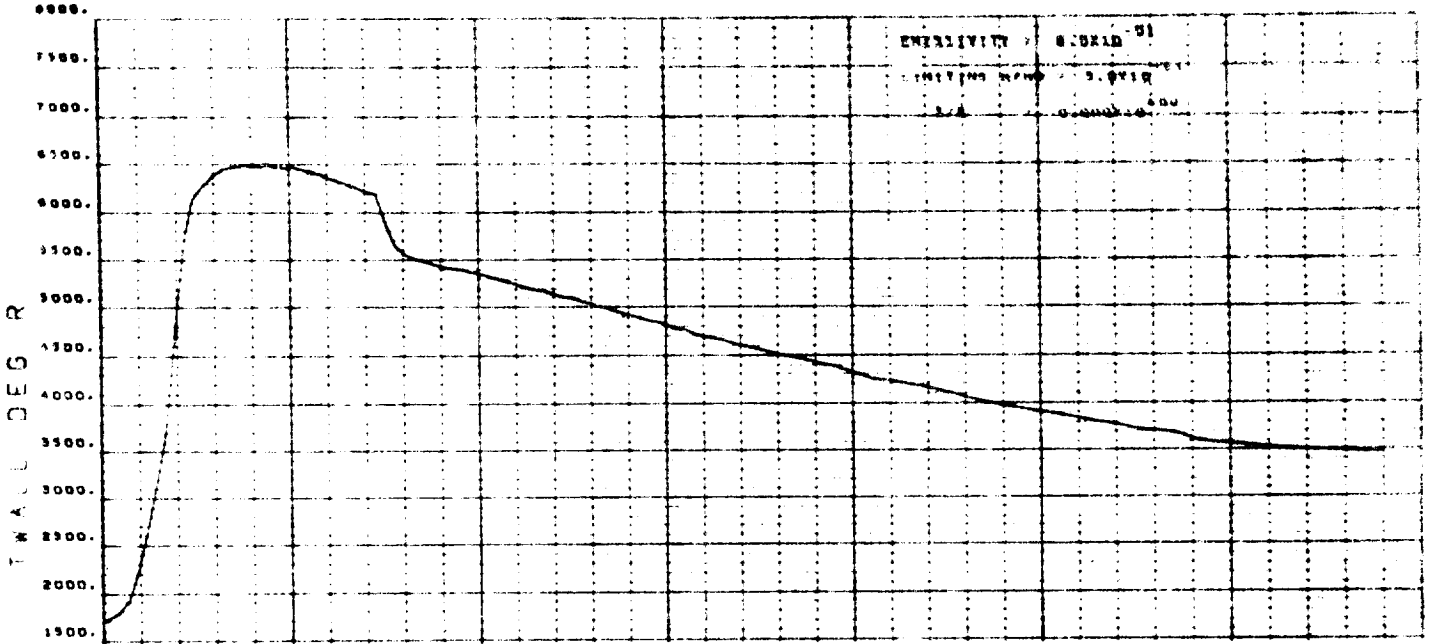


FIGURE B44

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VE=30000 - TRAJECTORY US-20 AND US-27

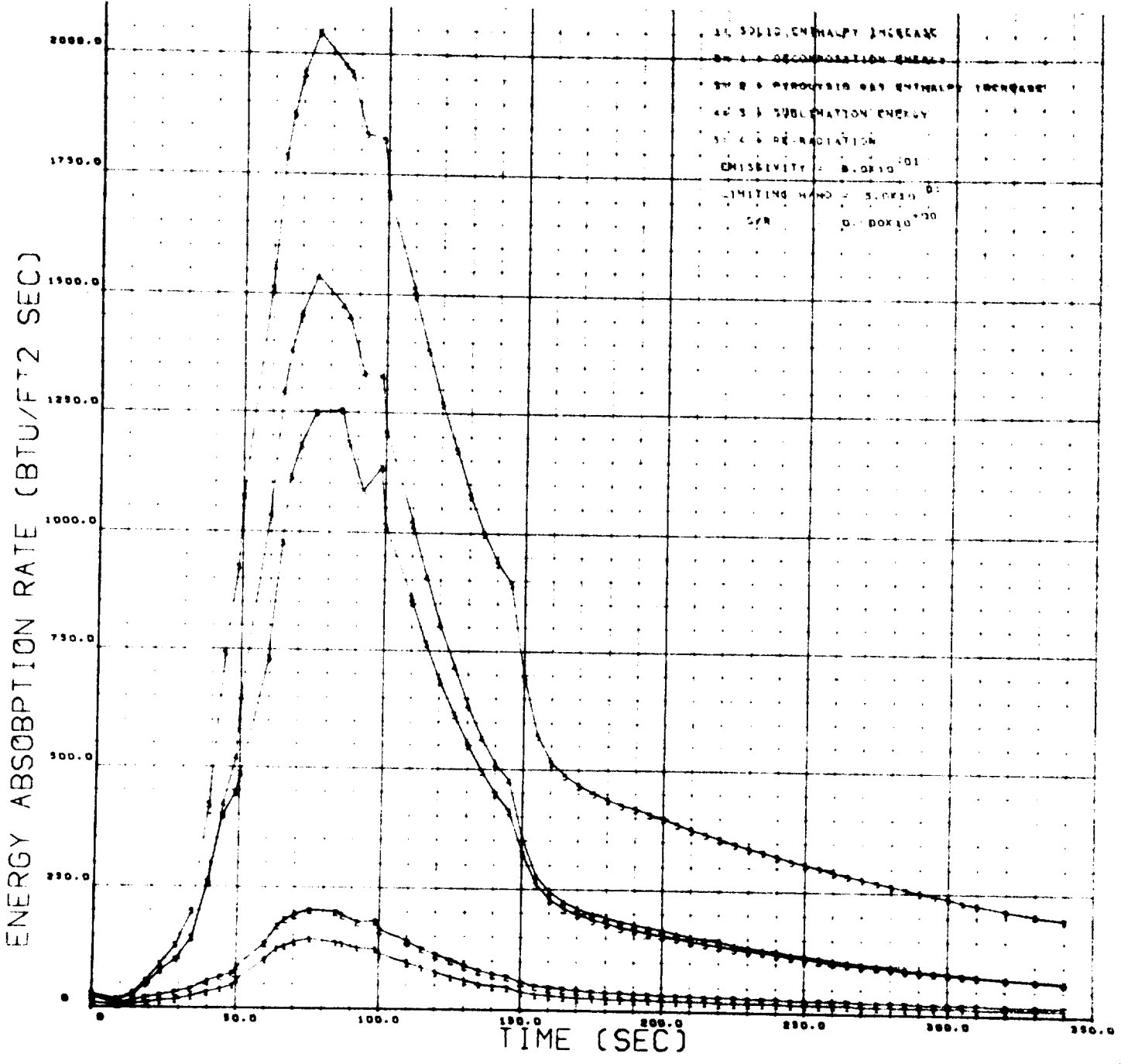


FIGURE B 45

HEATING RATE HISTORY

UPPER BOUNDARY VE=8000 - TRAJECTORY UB-56 AND UB-57

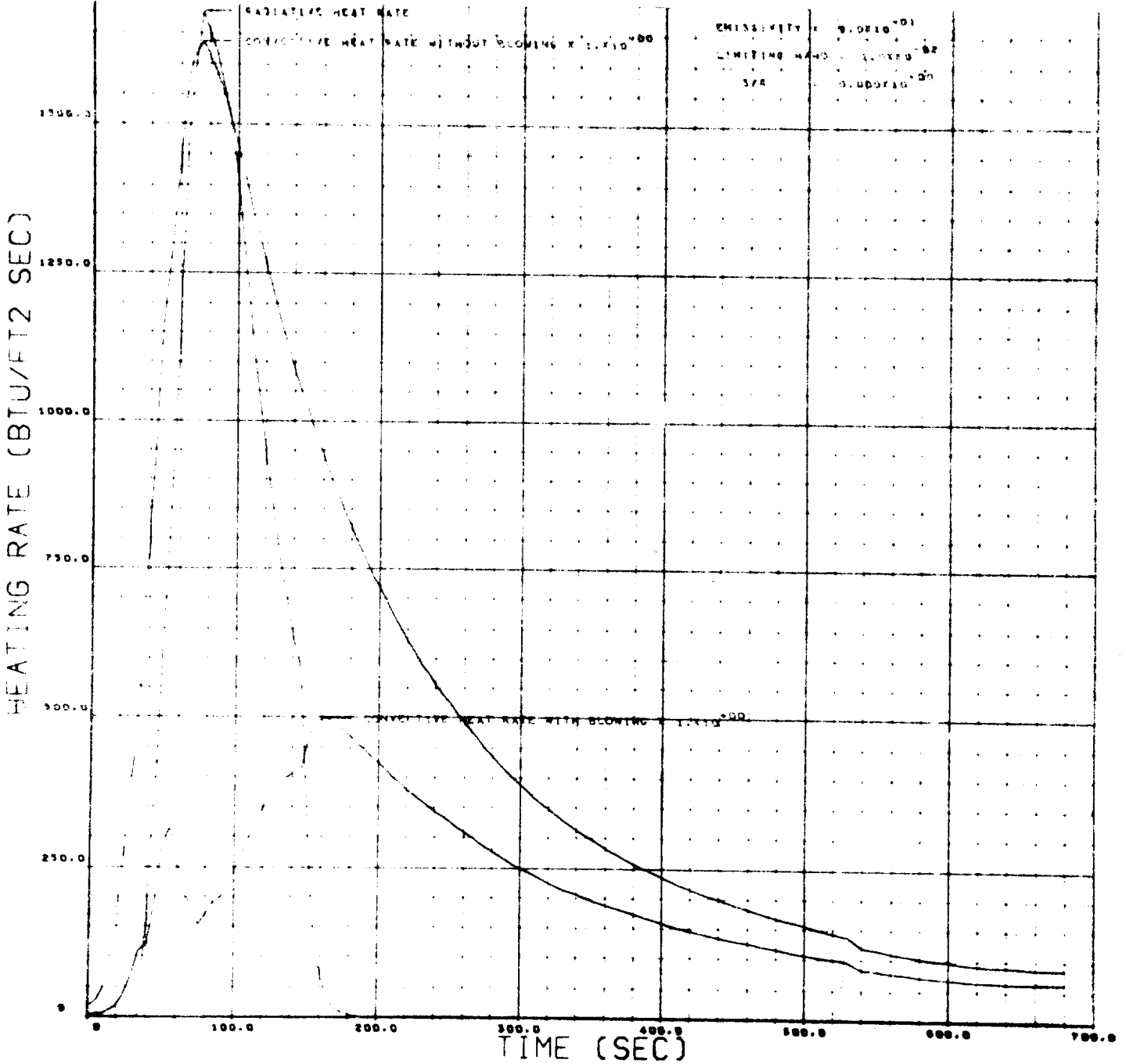


FIGURE B45

MATERIAL RESPONSE DATA

UPPER BOUNDARY VE: 30000 TRAJECTORY US-55 AND US-17

EMISSIVITY: 0.0818-01
LIMITING WPM: 1.9710-02
3.48 0.0000-000

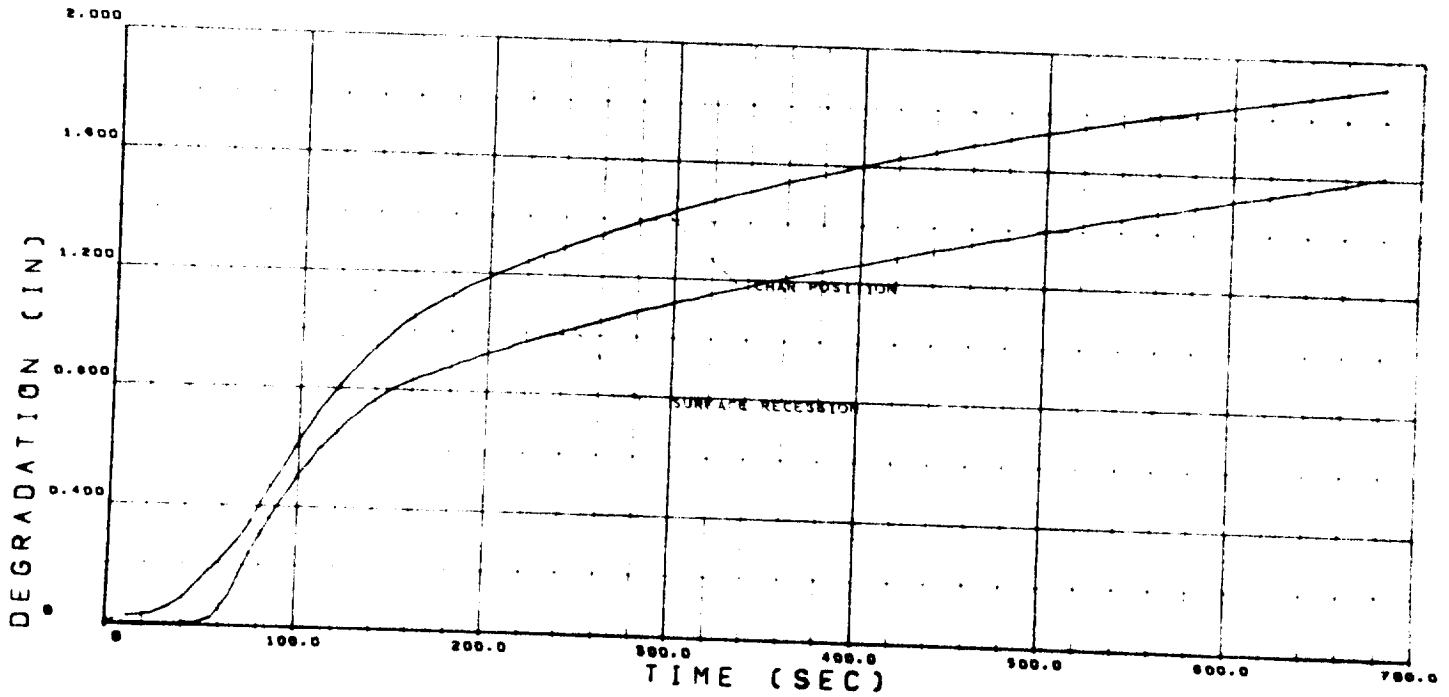
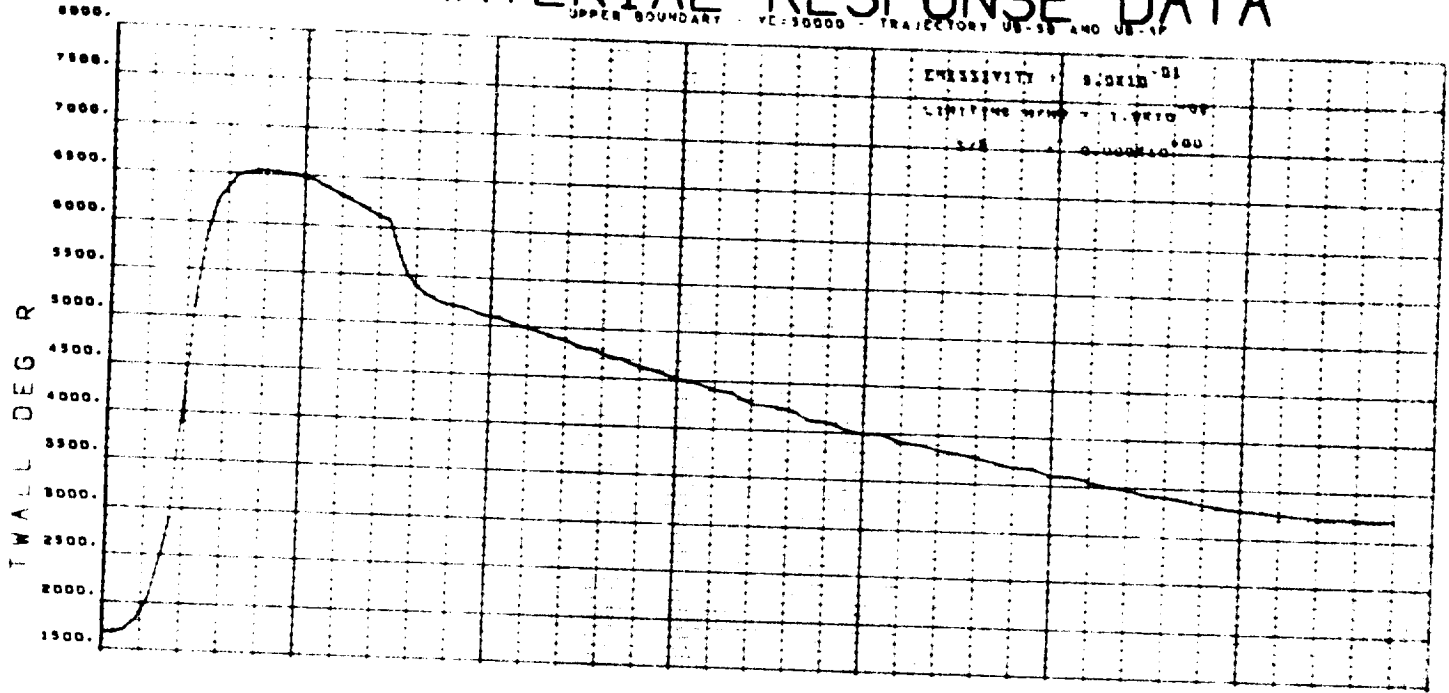


FIGURE B45

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VE=50000 - TRAJECTORY US-58 AND UB-57

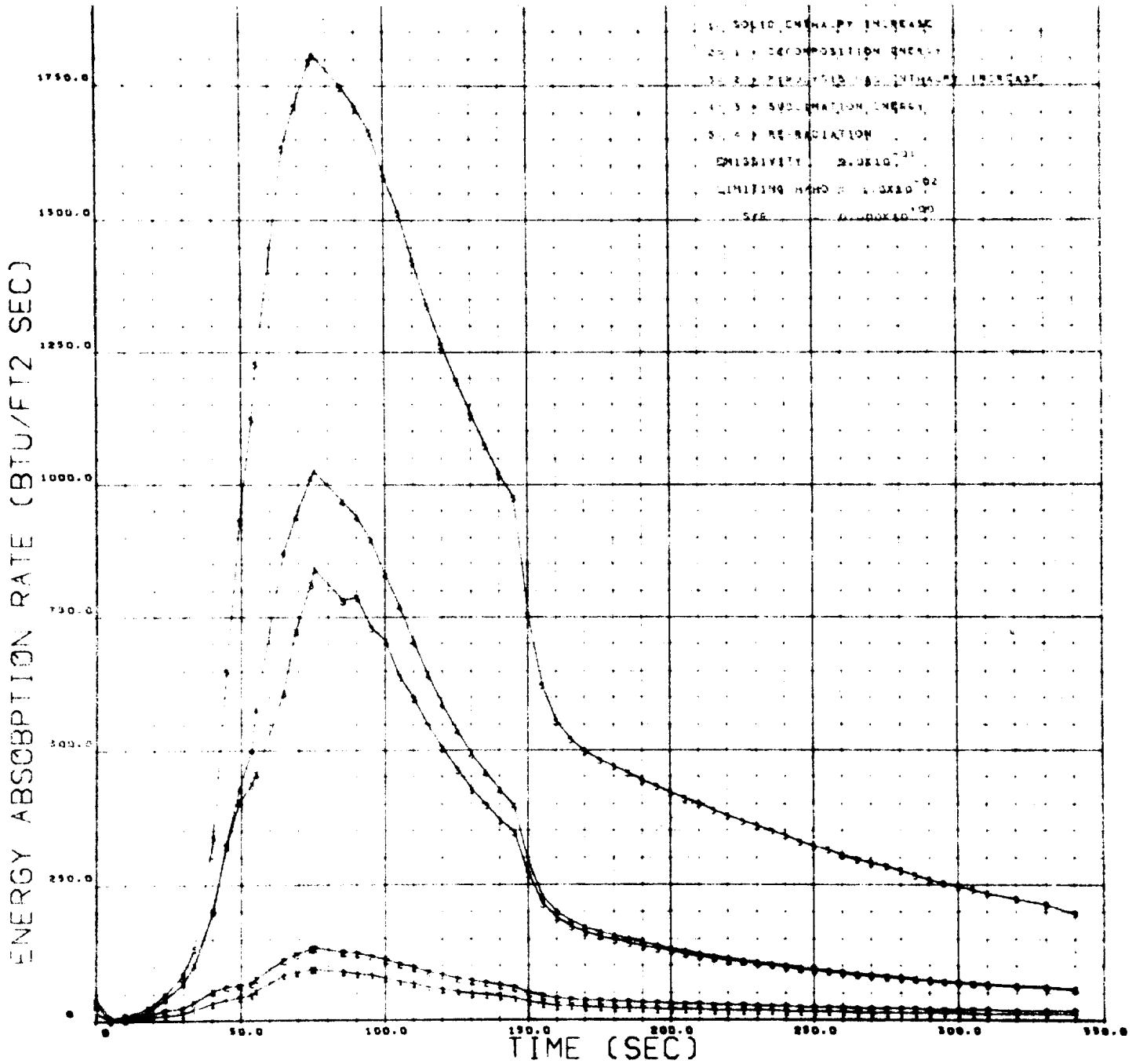


FIGURE B46

HEATING RATE HISTORY

UPPER BOUNDARY - 1E+30000 TRAJECTORY UG-18 AND UG-17

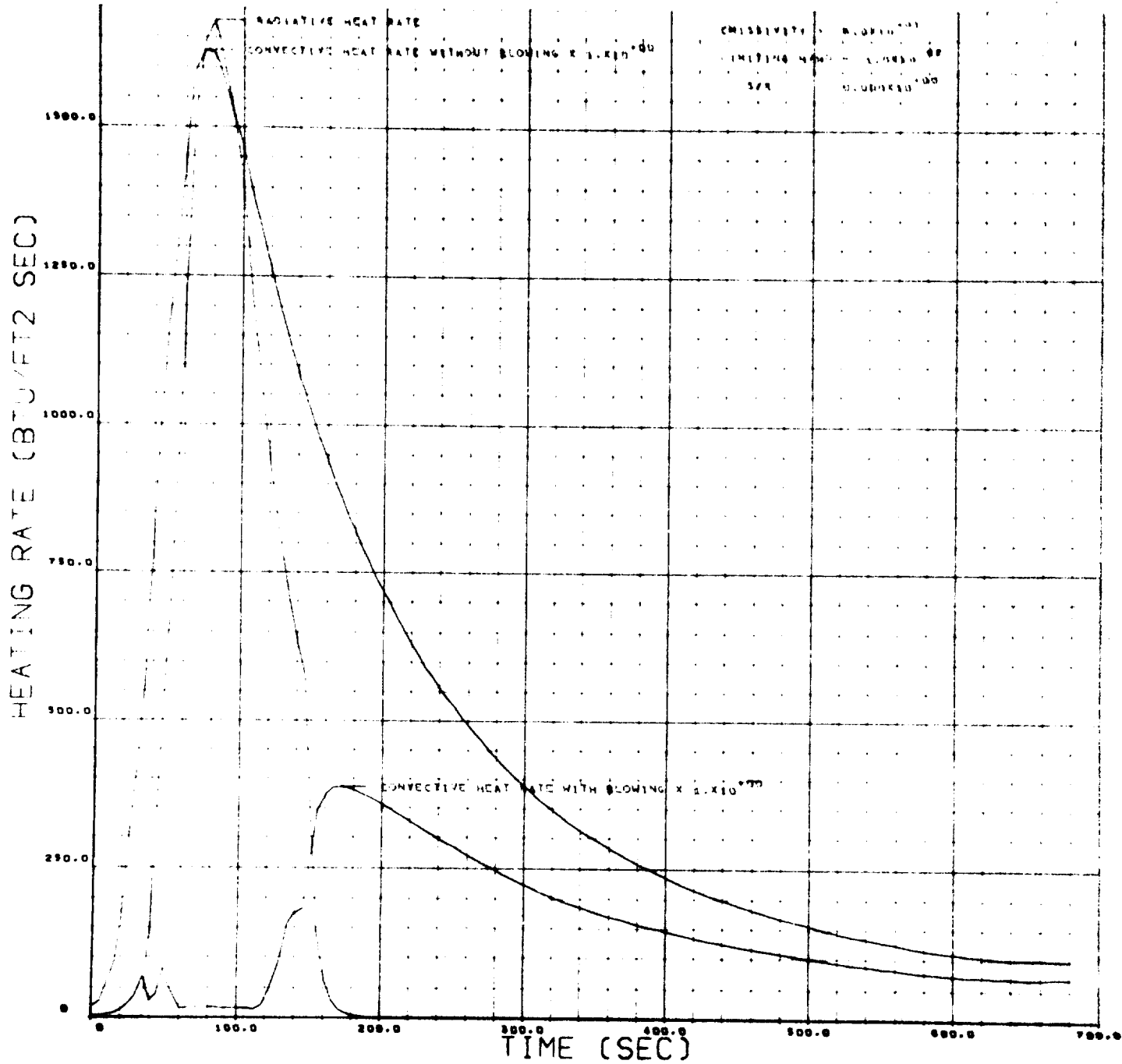


FIGURE B46

MATERIAL RESPONSE DATA

UPPER BOUNDARY VE: 50000 TRAJECTORY 05-15 AND 06-17

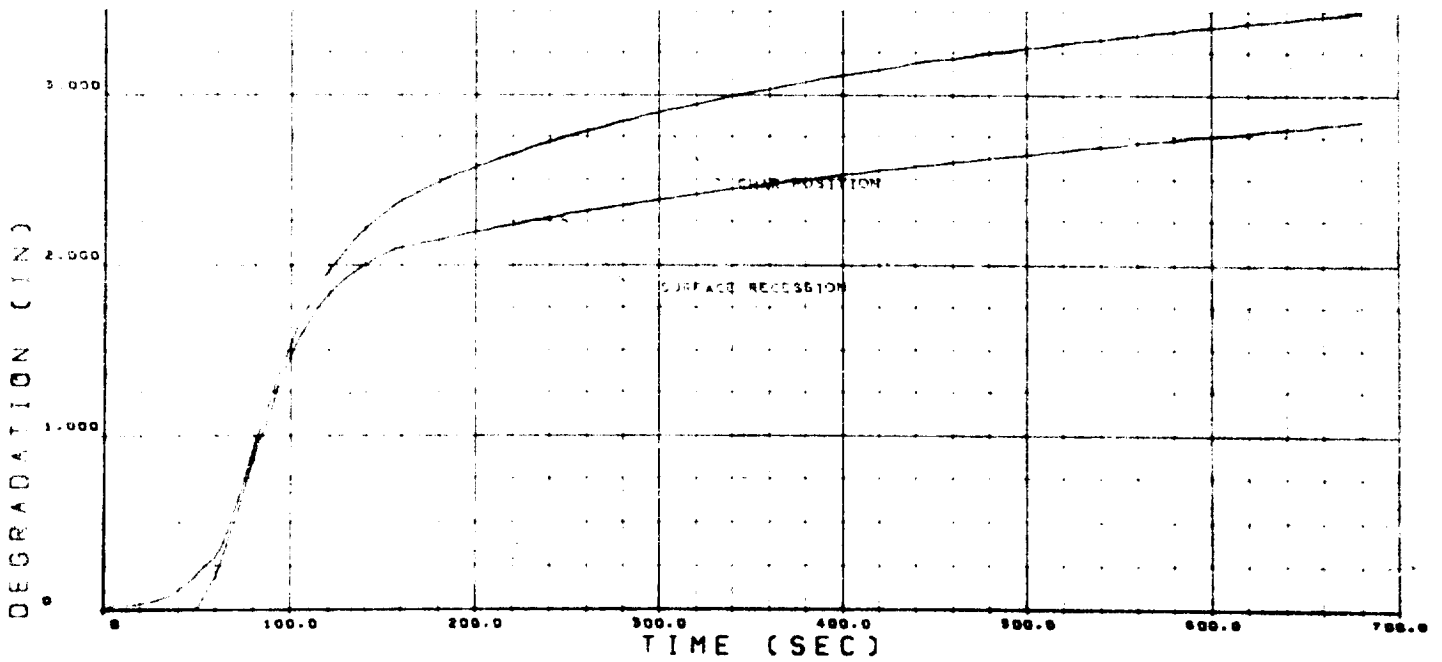
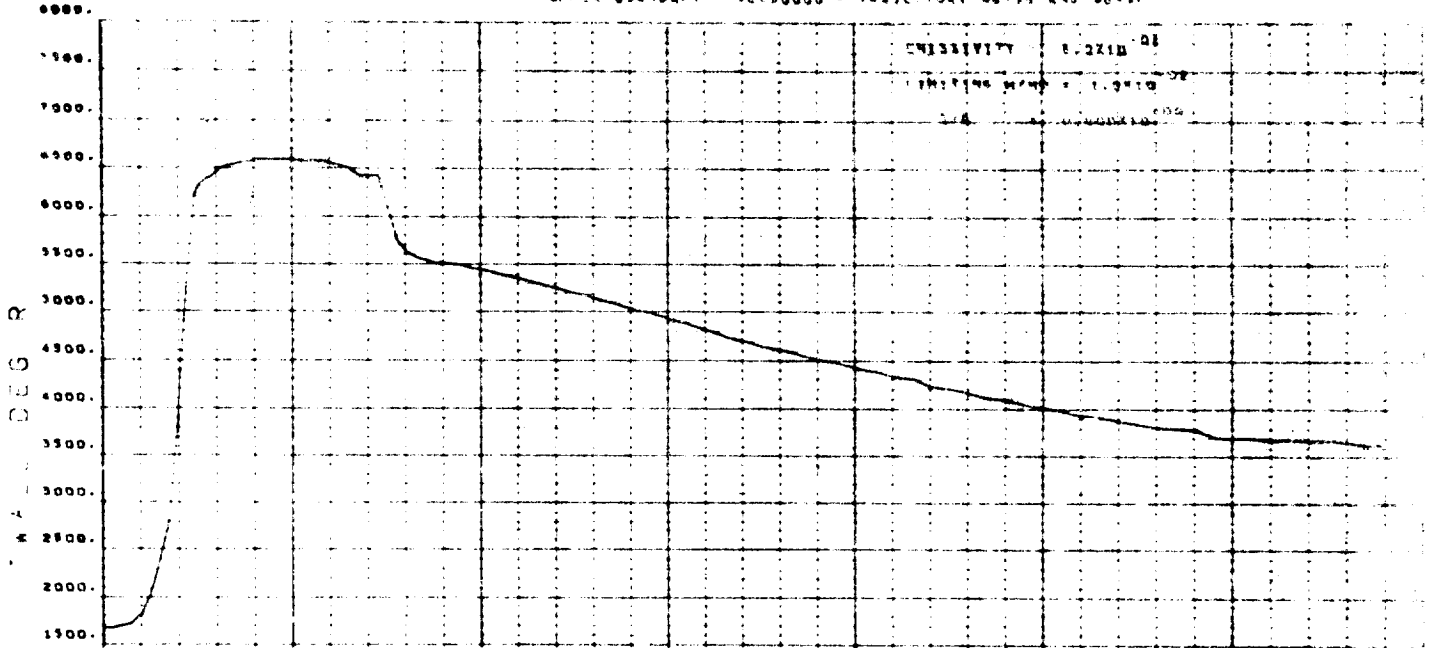


FIGURE B46

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VE=10000 - TRAJECTORY US-98 AND US-97

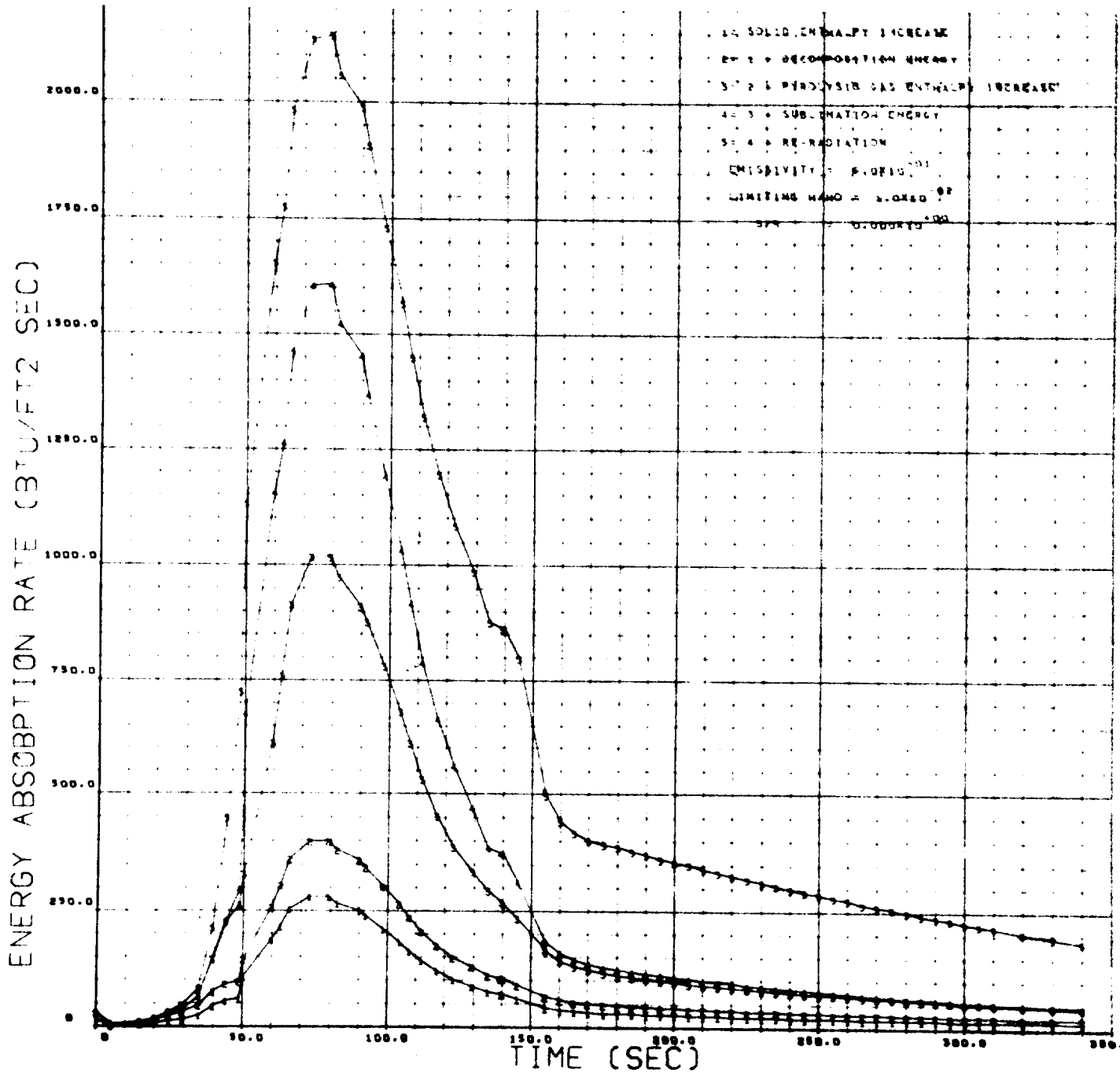


FIGURE B47

HEATING RATE HISTORY

UPPER BOUNDARY - VE=30000 - TRAJECTORY OF UG AND UG-17

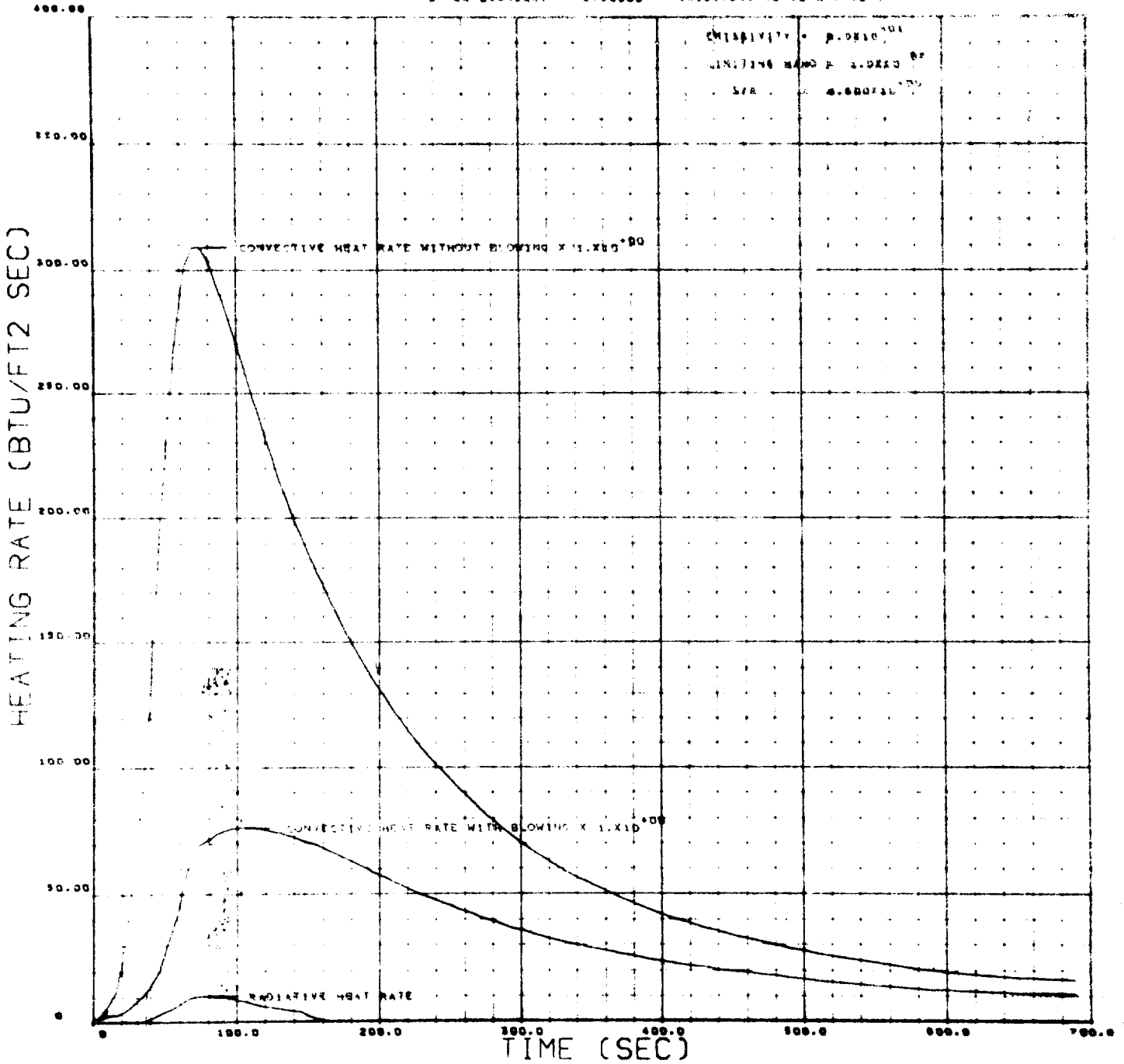


FIGURE 547

MATERIAL RESPONSE DATA

UPPER BOUNDARY - VE=30000 - TRAJECTORY UB-98 AND UB-97

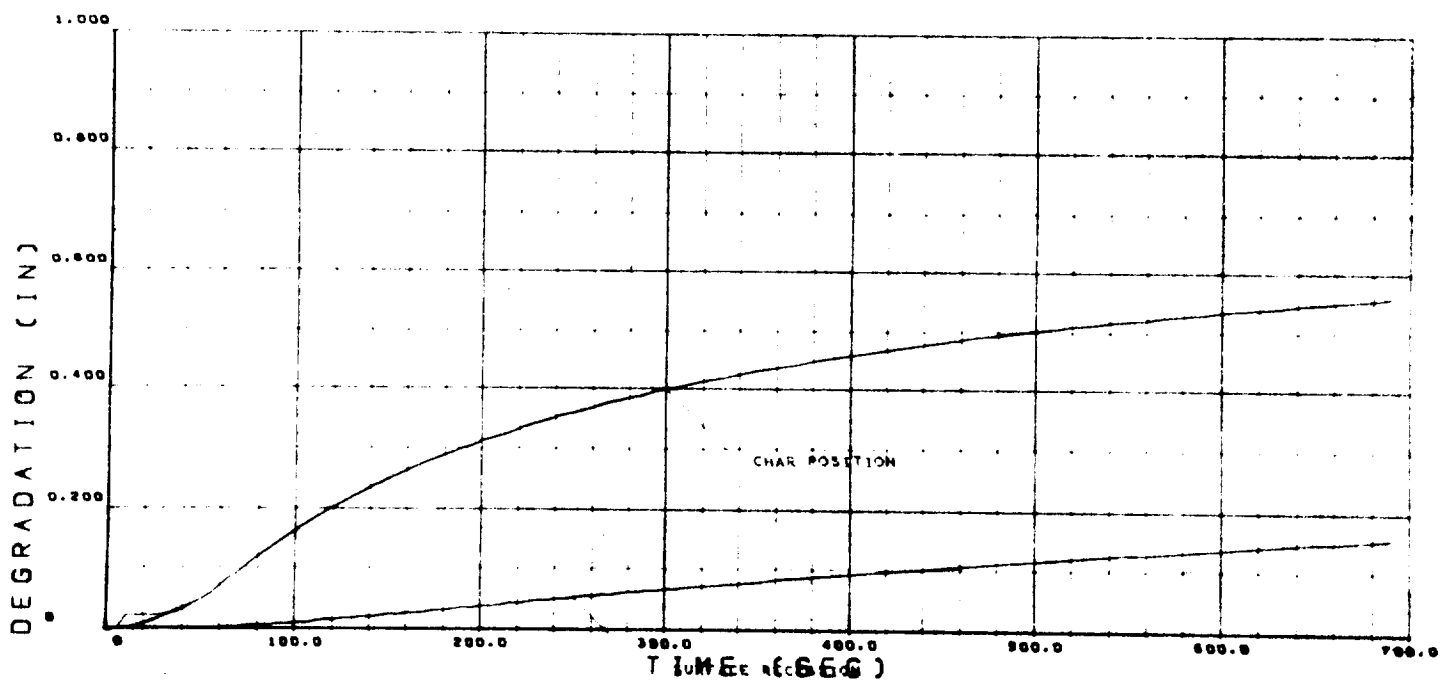
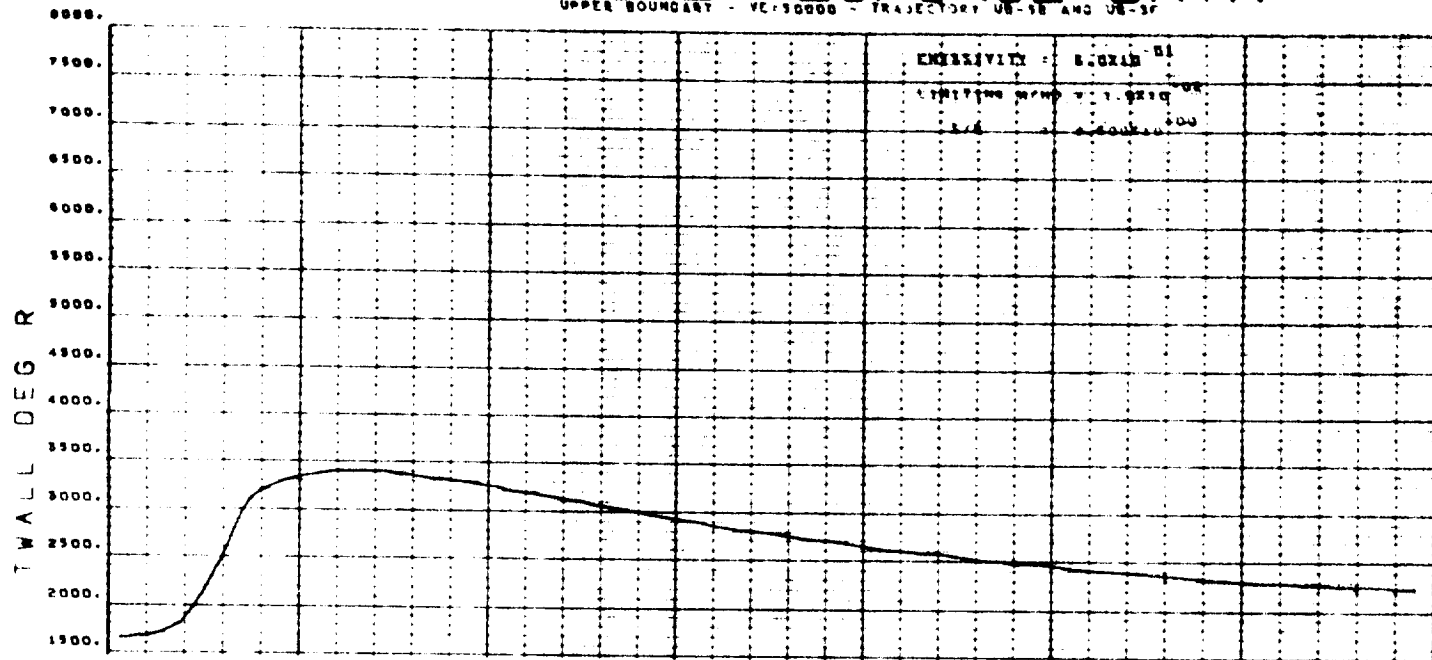


FIGURE B47

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY VC-30000 TRAJECTORY US-38 AND US-37

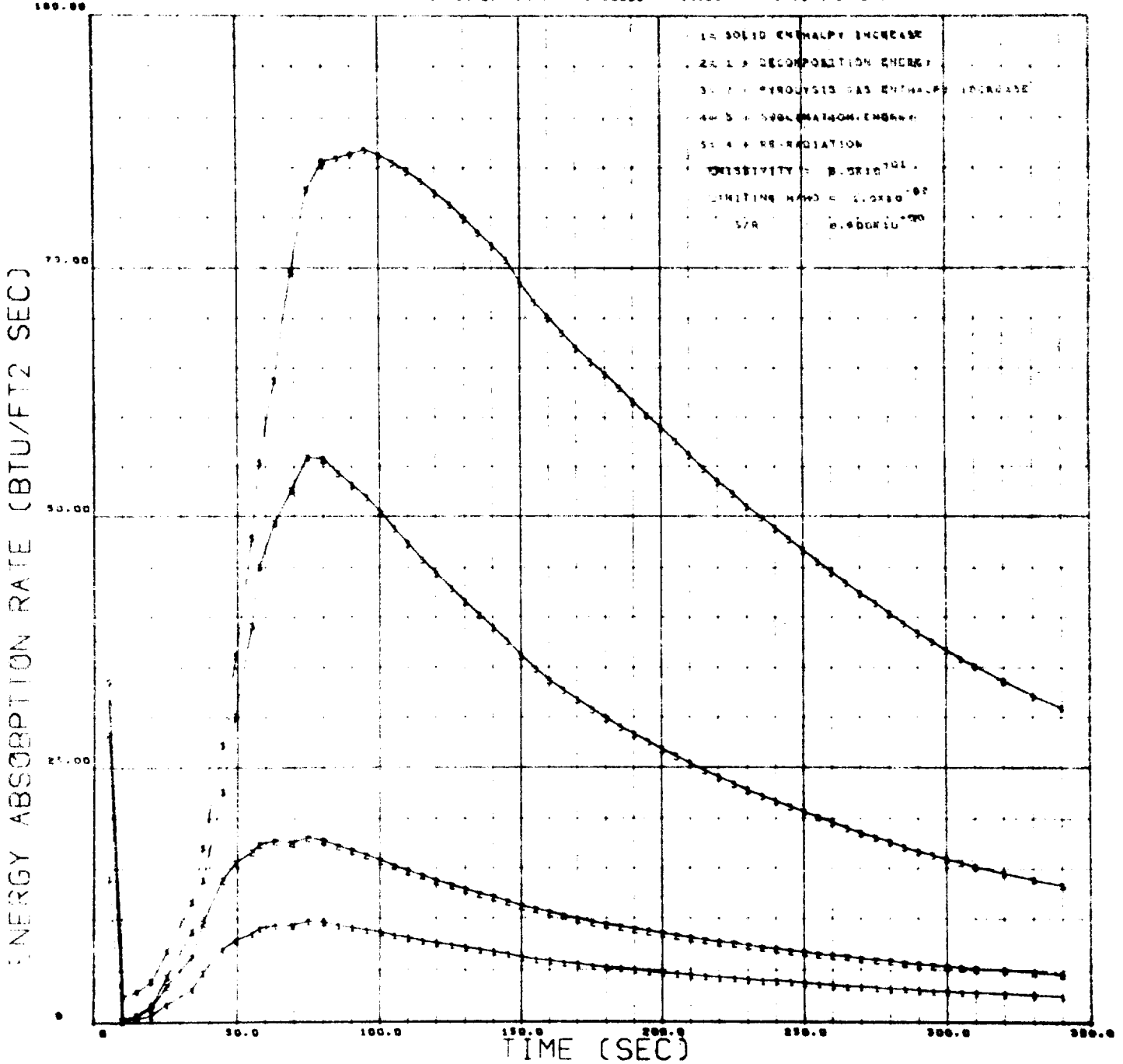


FIGURE B 48

HEATING RATE HISTORY

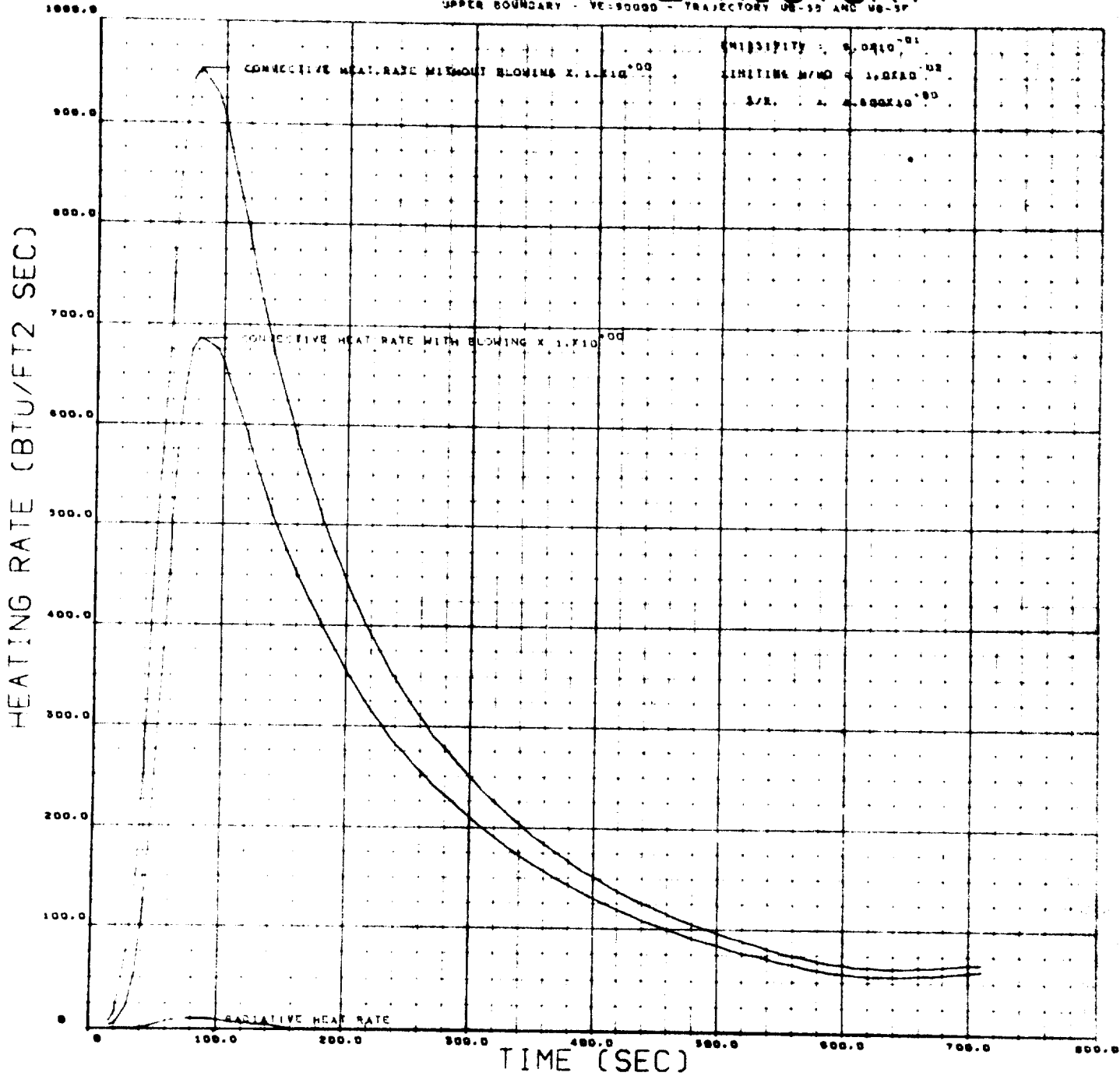


FIGURE B49

MATERIAL RESPONSE DATA

UPPER BOUNDARY - 17-30000 TRAJECTORY US-51 AND US-52

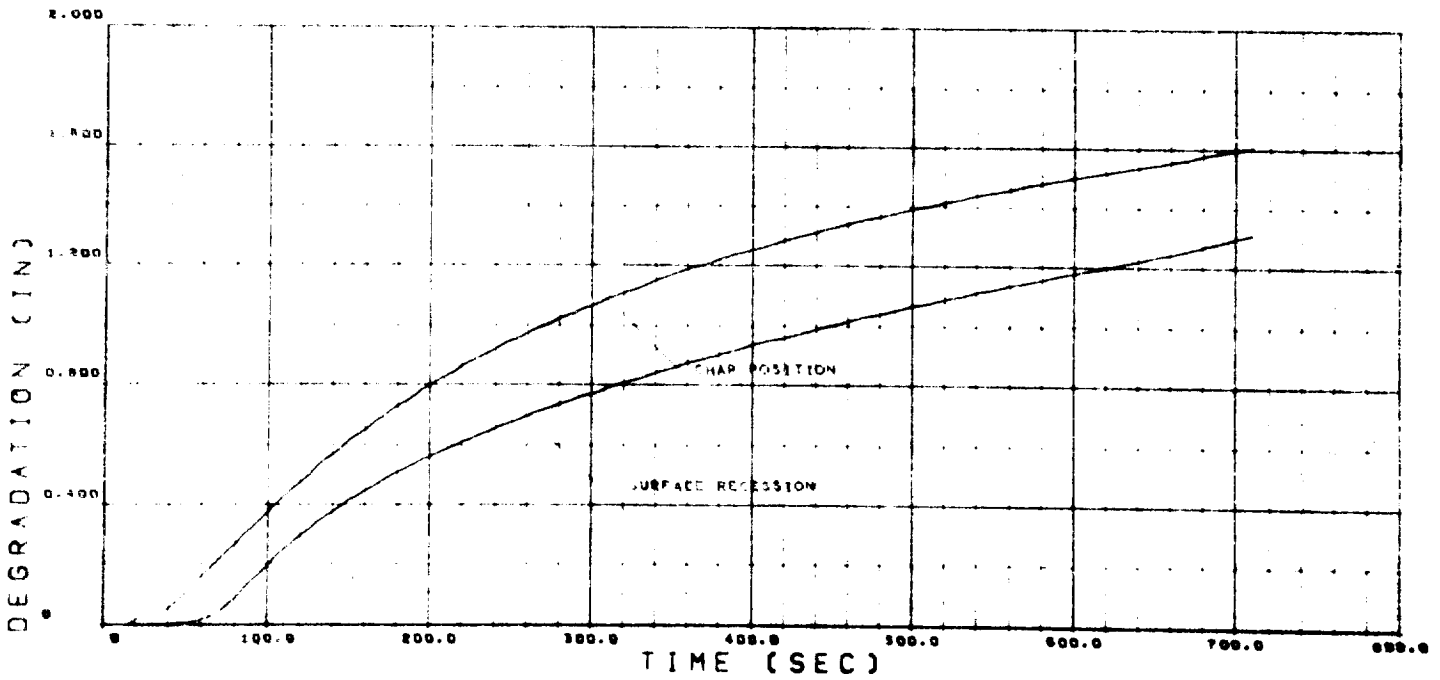
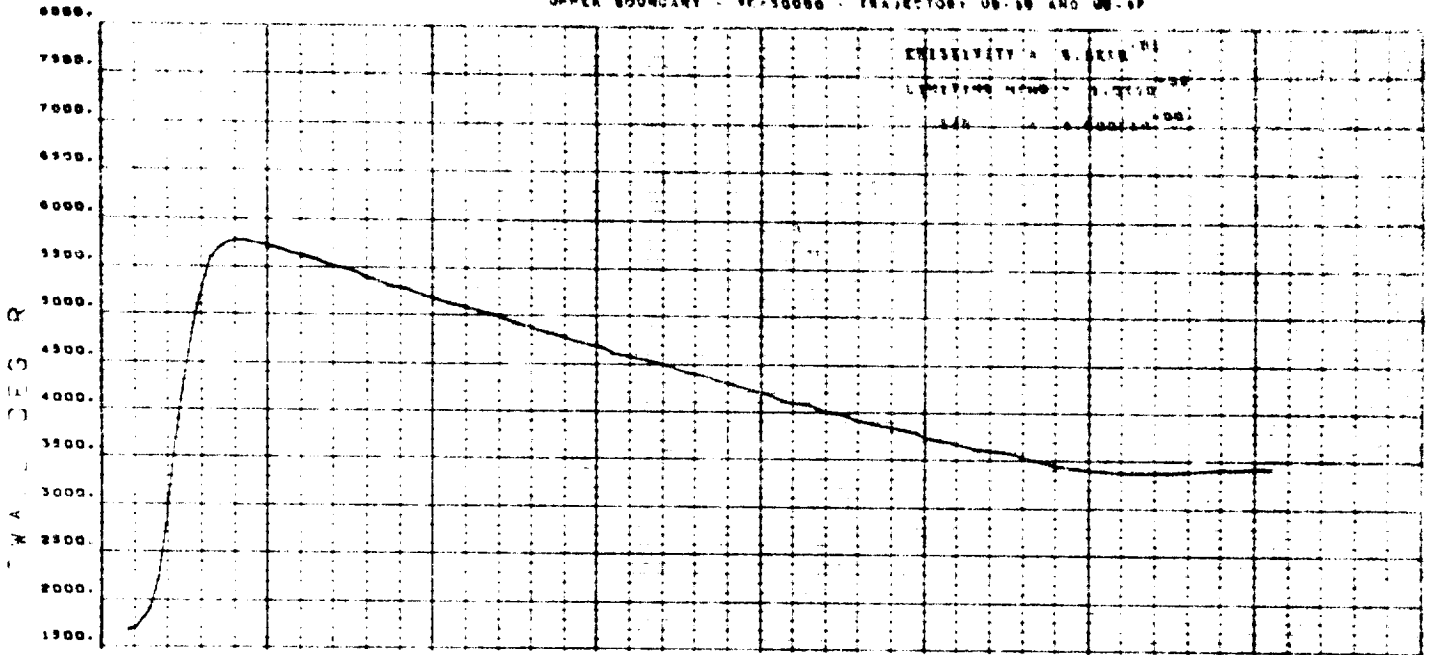


FIGURE 1348

ENERGY ACCOMMODATION MECHANISMS

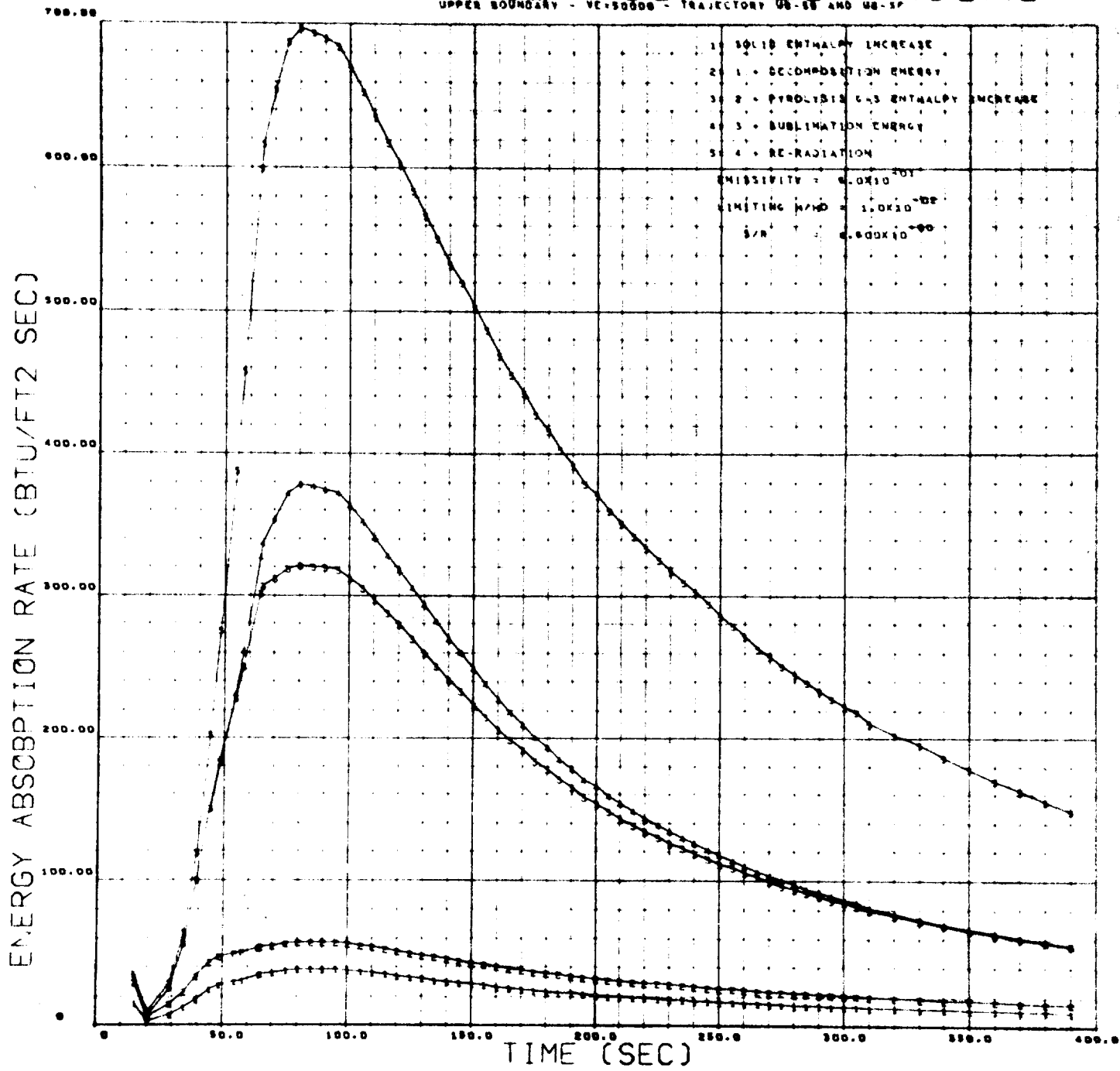


FIGURE 849

HEATING RATE HISTORY

UPPER BOUNDARY - VE=70000 - TRAJECTORY UB-50 AND UB-57

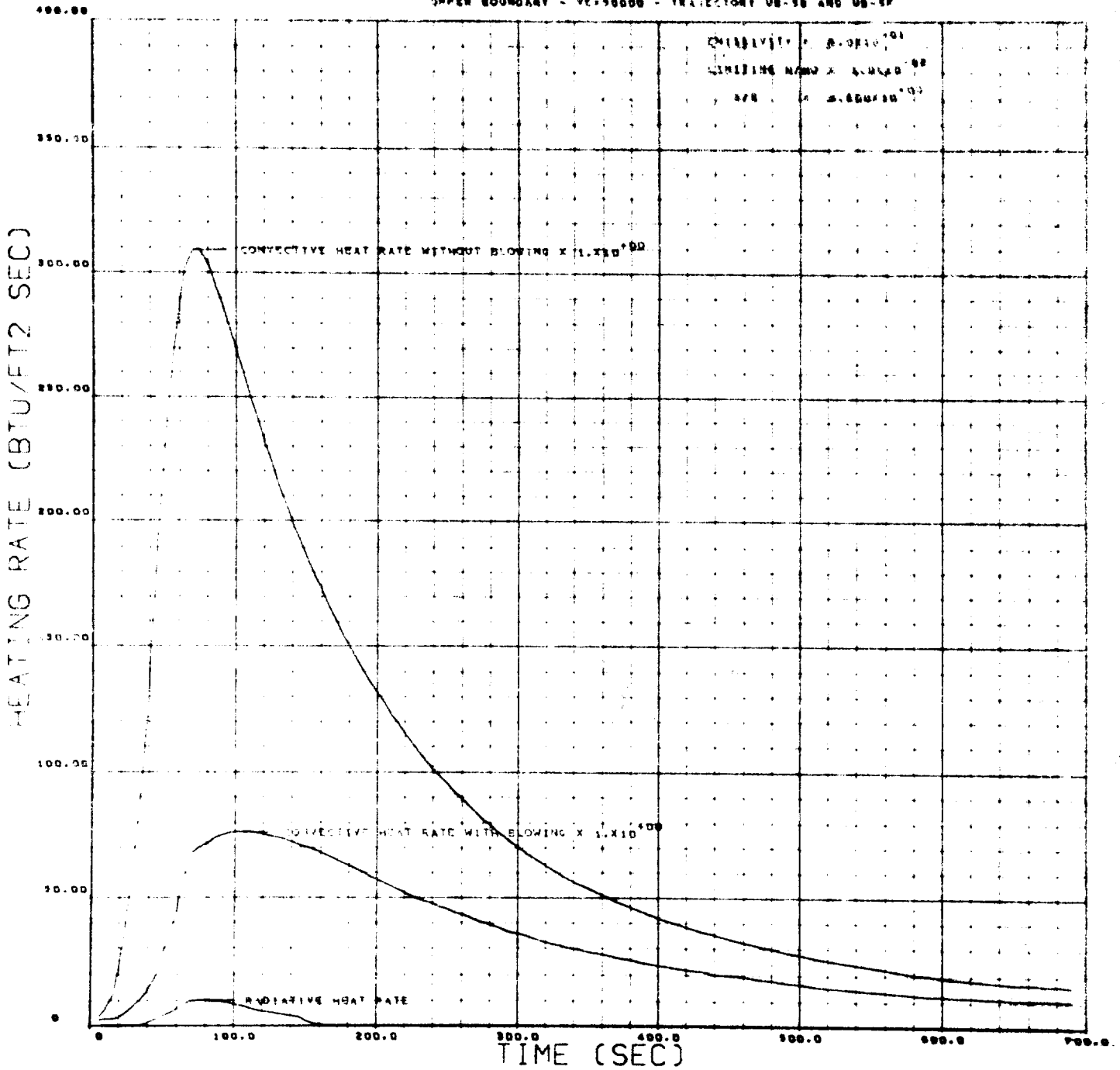


FIGURE 349

MATERIAL RESPONSE DATA

UPPER BOUNDARY - VE=30000 - TRAJECTORY US-10 AND US-17

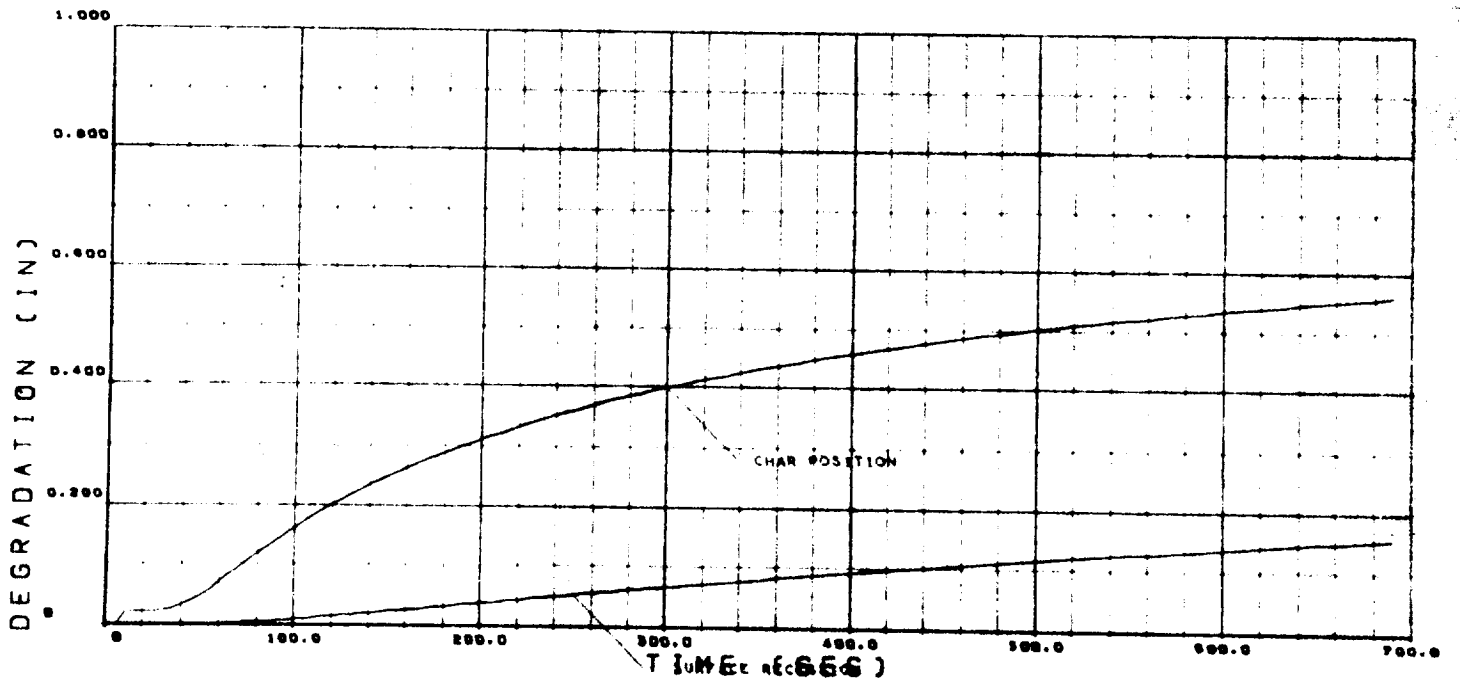
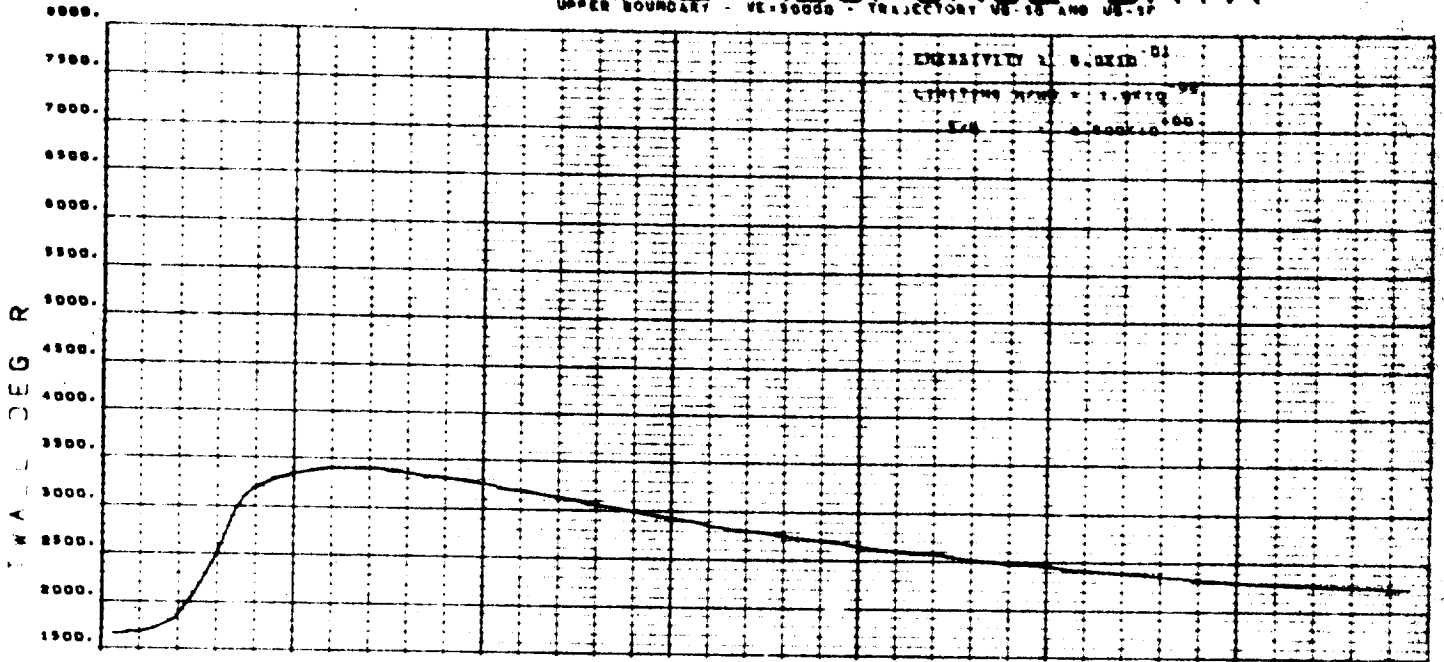


FIGURE B49

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VE=30000 - TRAJECTORY US-38 AND US-37

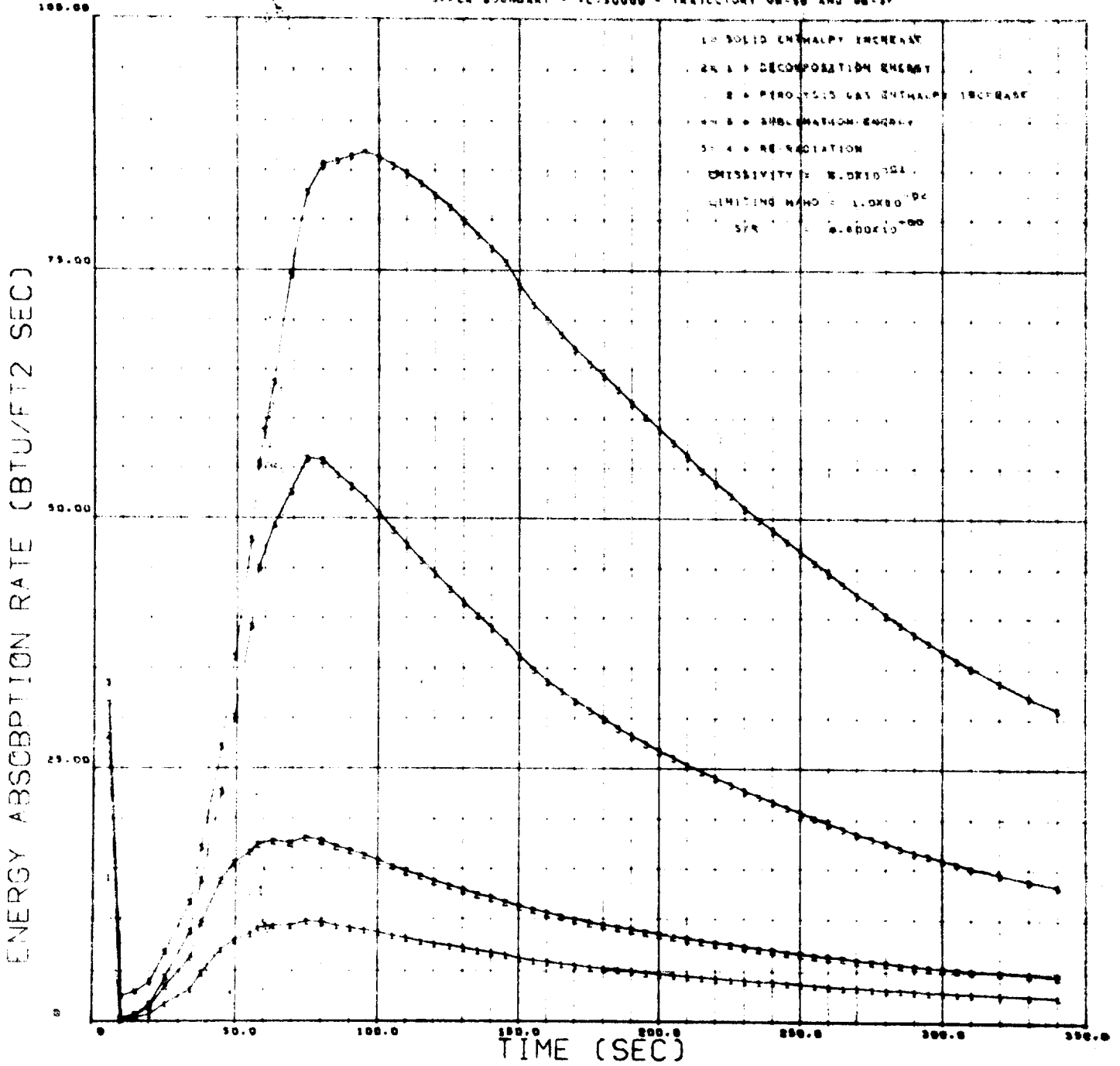


FIGURE B50

HEATING RATE HISTORY

UPPER BOUNDARY - YF=50000 - TRAJECTORY UB-58 AND UB-57

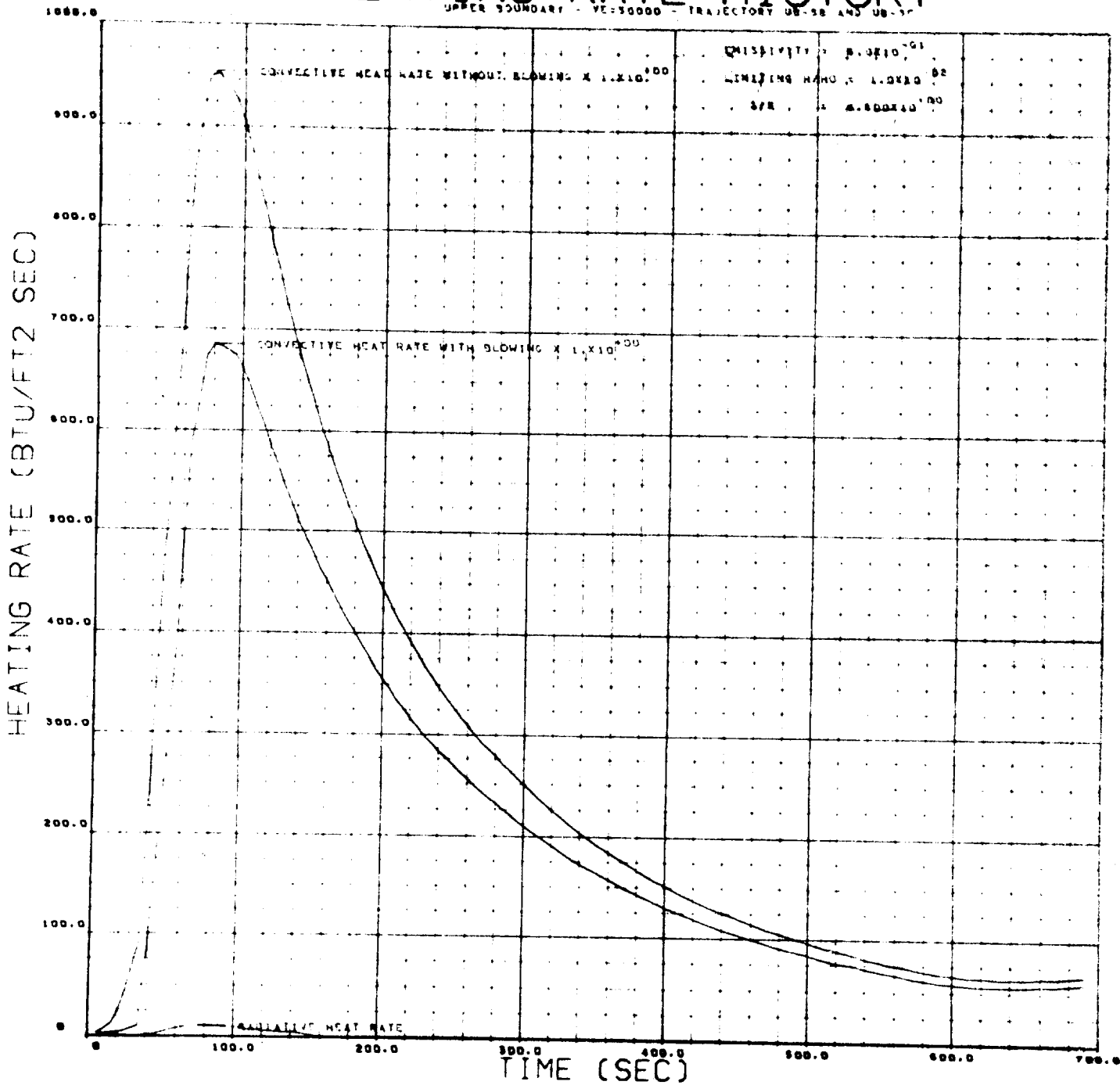
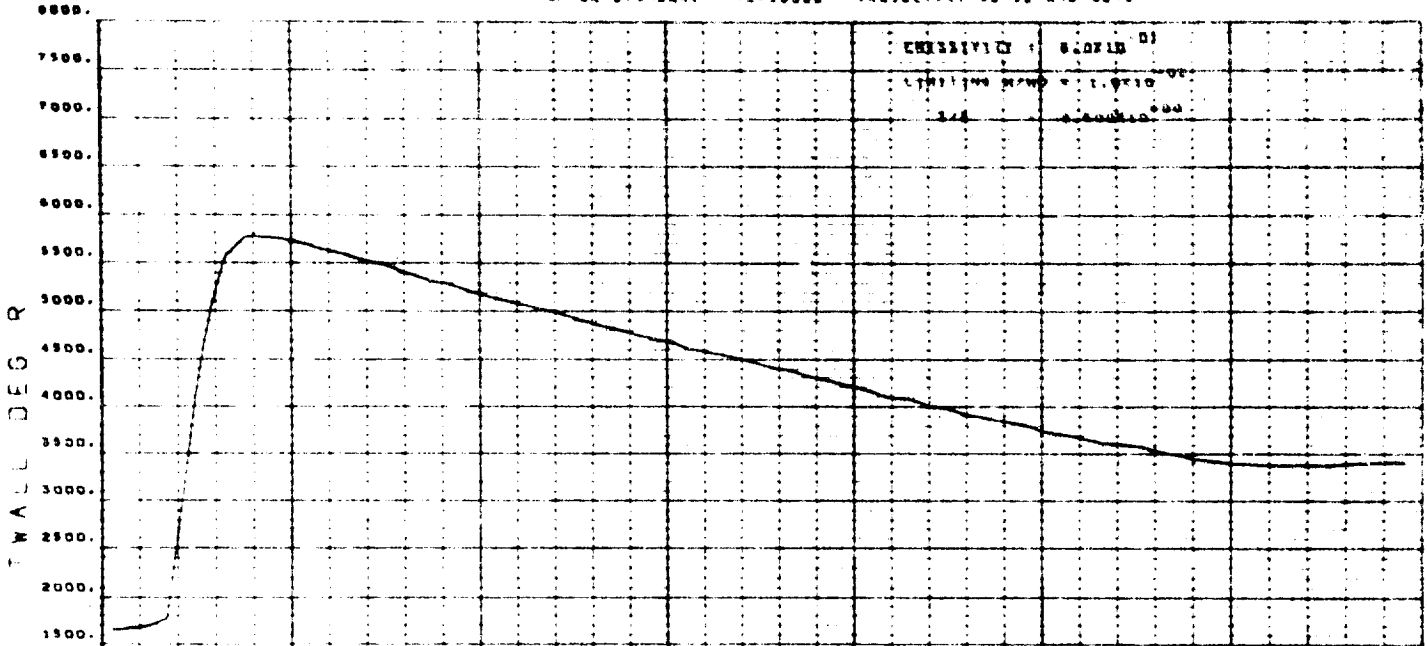


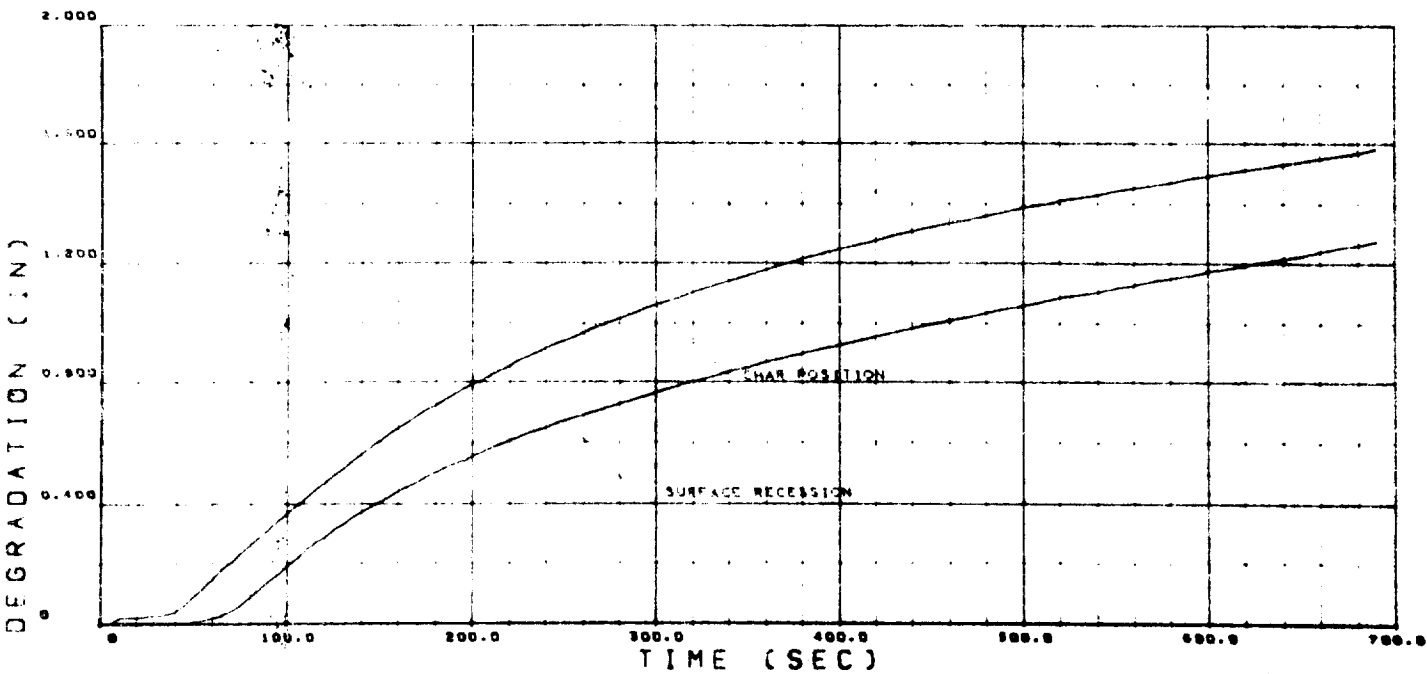
FIGURE B.50

MATERIAL RESPONSE DATA

UPPER BOUNDARY - VE=10000 - TRAJECTORY US-95 AND US-97



EXPOSURE : 8.0215 01
LIGHTING RATE : 1.0710 00
S.S. : 0.0000 000



500

FIGURE B50

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VE=10000 - TRAJECTORY UE-55 AND UE-57

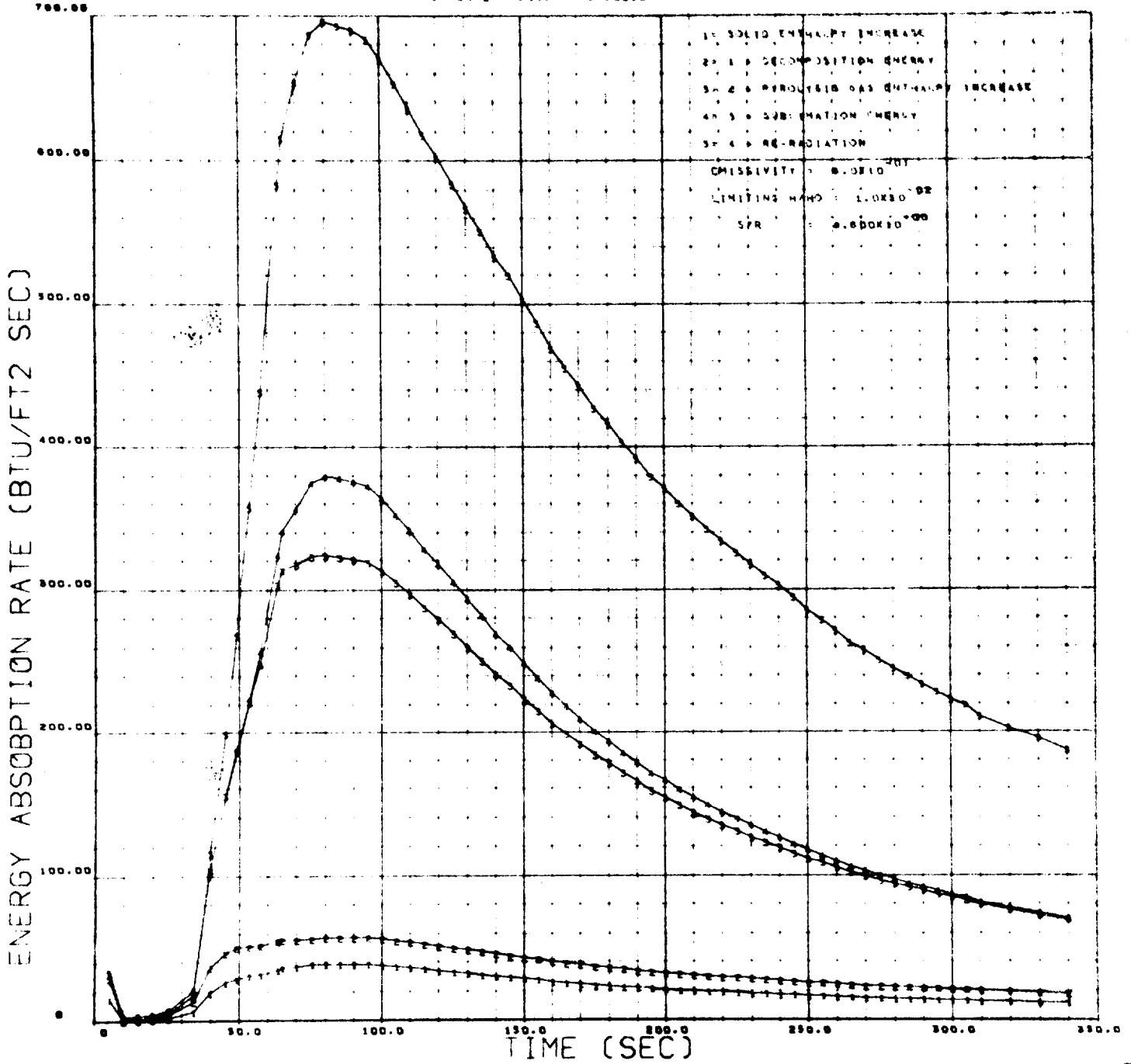


FIGURE B51

HEATING RATE HISTORY

UPPER BOUNDARY - VE. 50000 - TRAJECTORY UB-50 AND UB-51

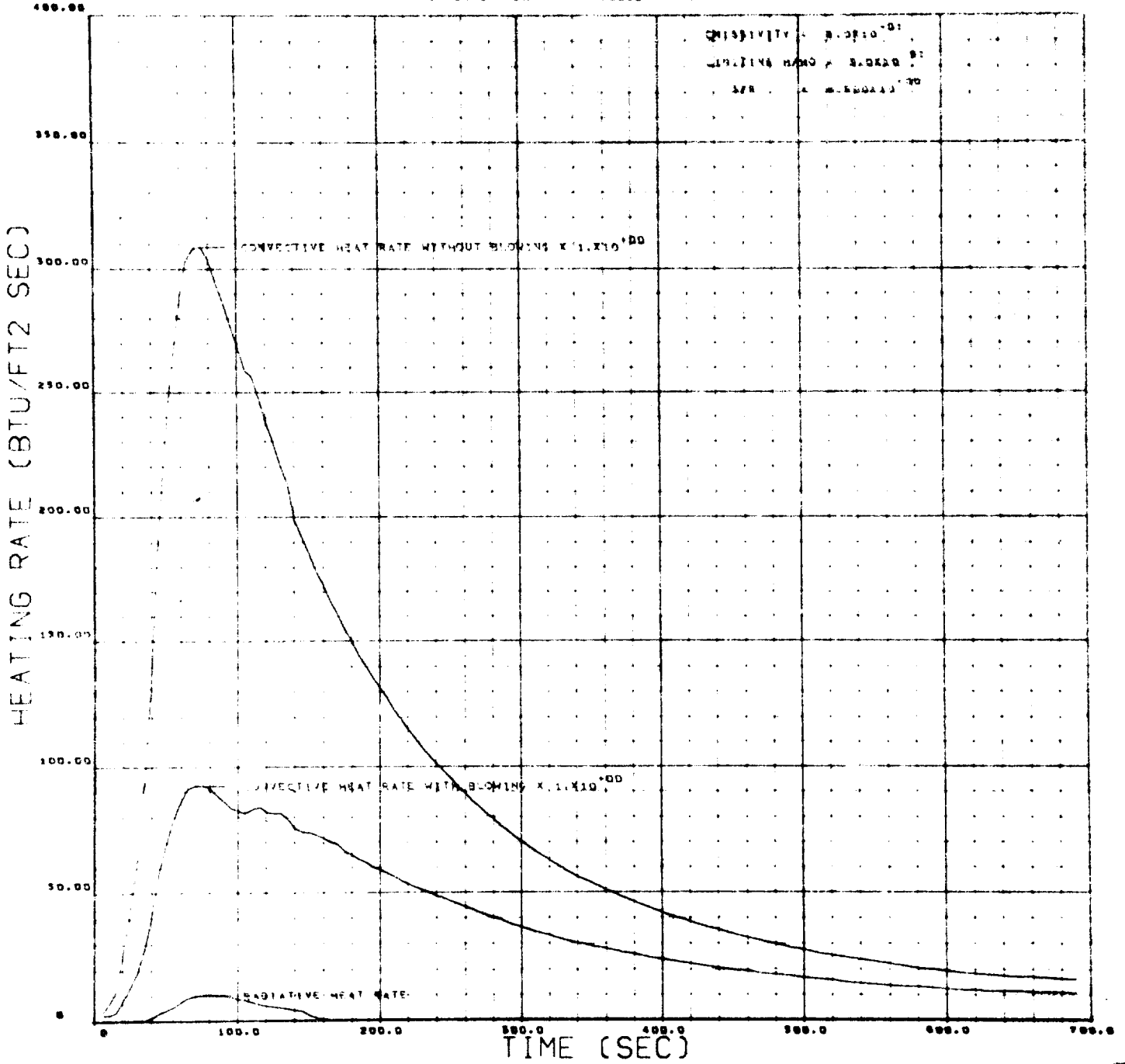
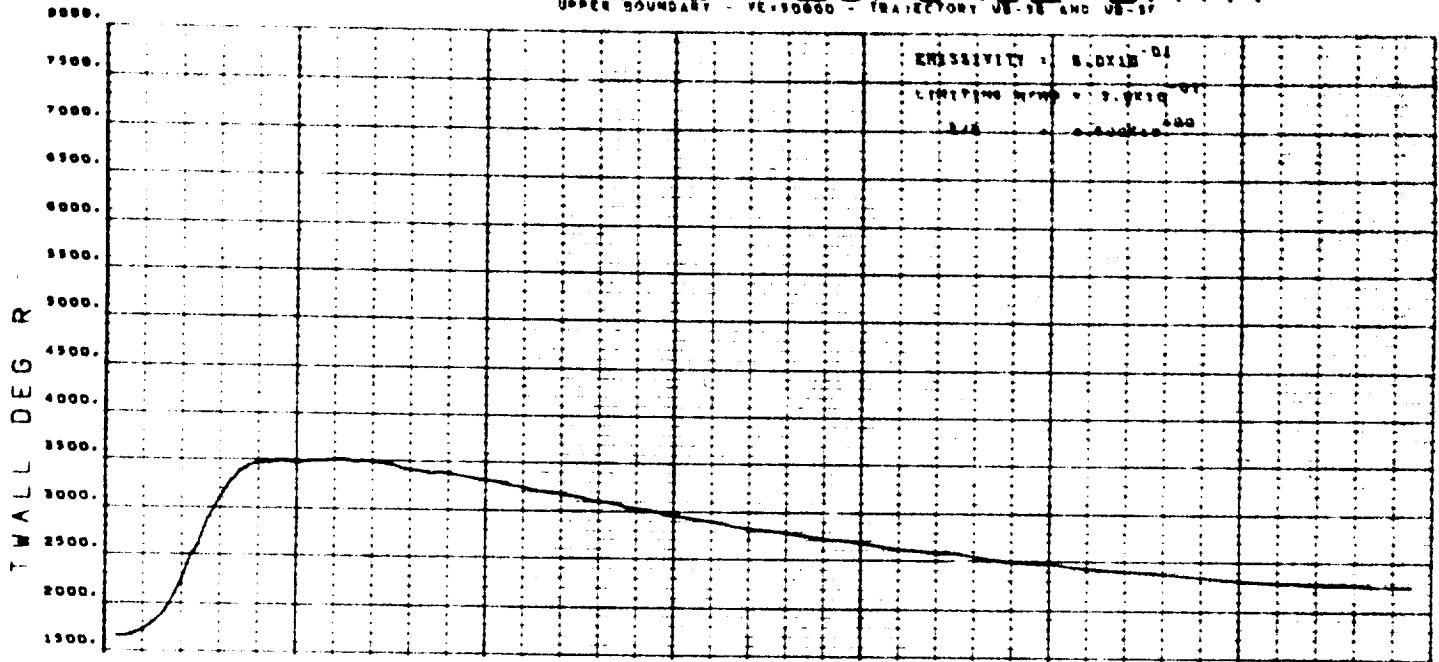


FIGURE 051

MATERIAL RESPONSE DATA

UPPER BOUNDARY - VE=10000 - TRAJECTORY 05-16 AND 05-17



PERMISSIVITY = 8.0X10⁻⁰¹
LIMITING HEAT FLUX = 2.0X10⁰⁷
S/S = 0.000000000

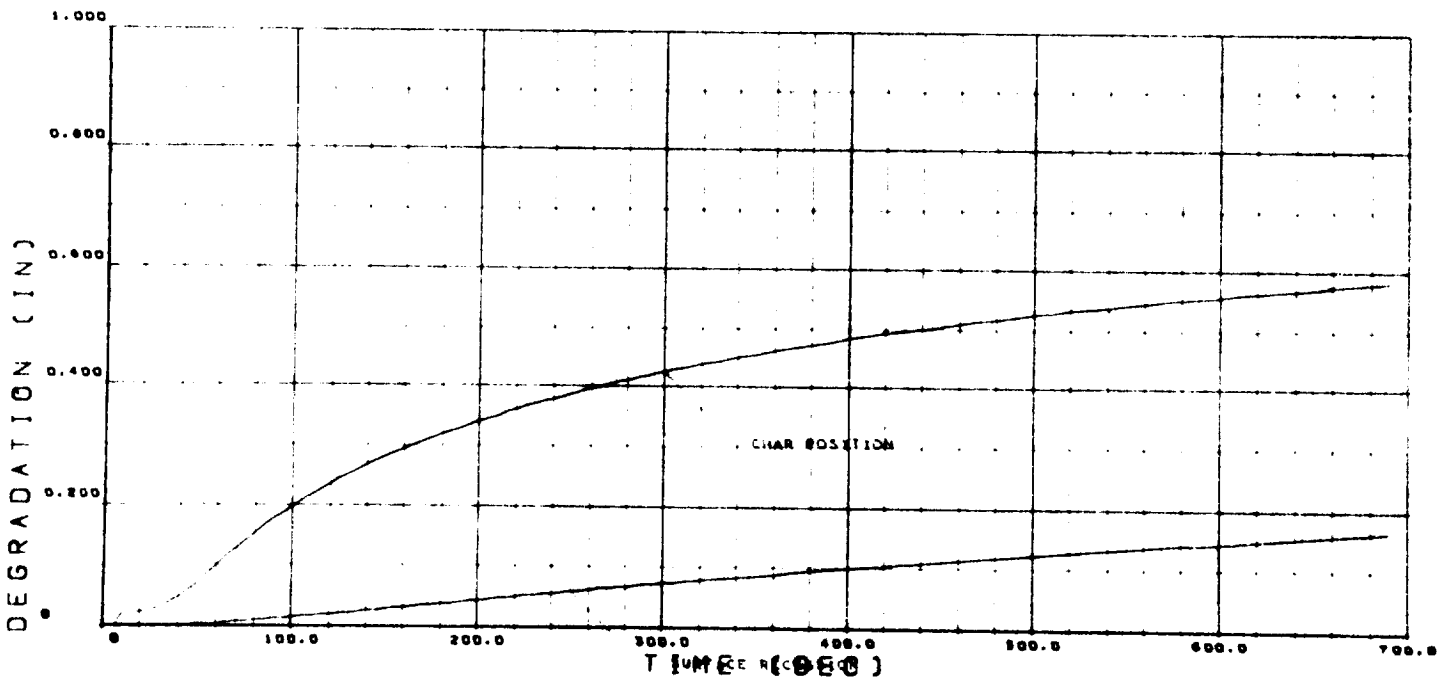


FIGURE B51

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VC-50300 - TRAJECTORY UR-3E AND UR-3F

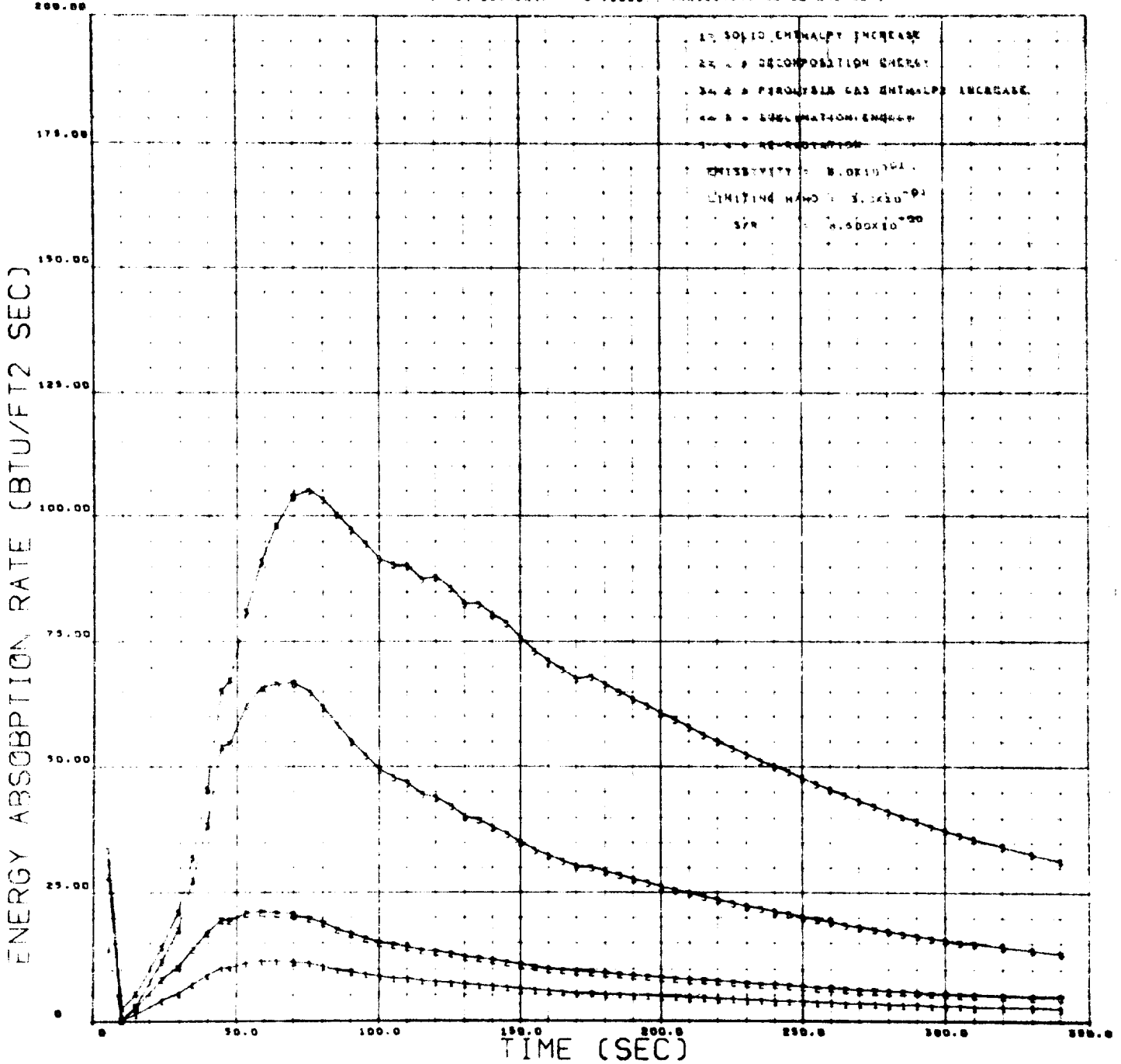


FIGURE B 52

HEATING RATE HISTORY

UPPER BOUNDARY - VE=30000 - TRAJECTORY US-30 AND US-37

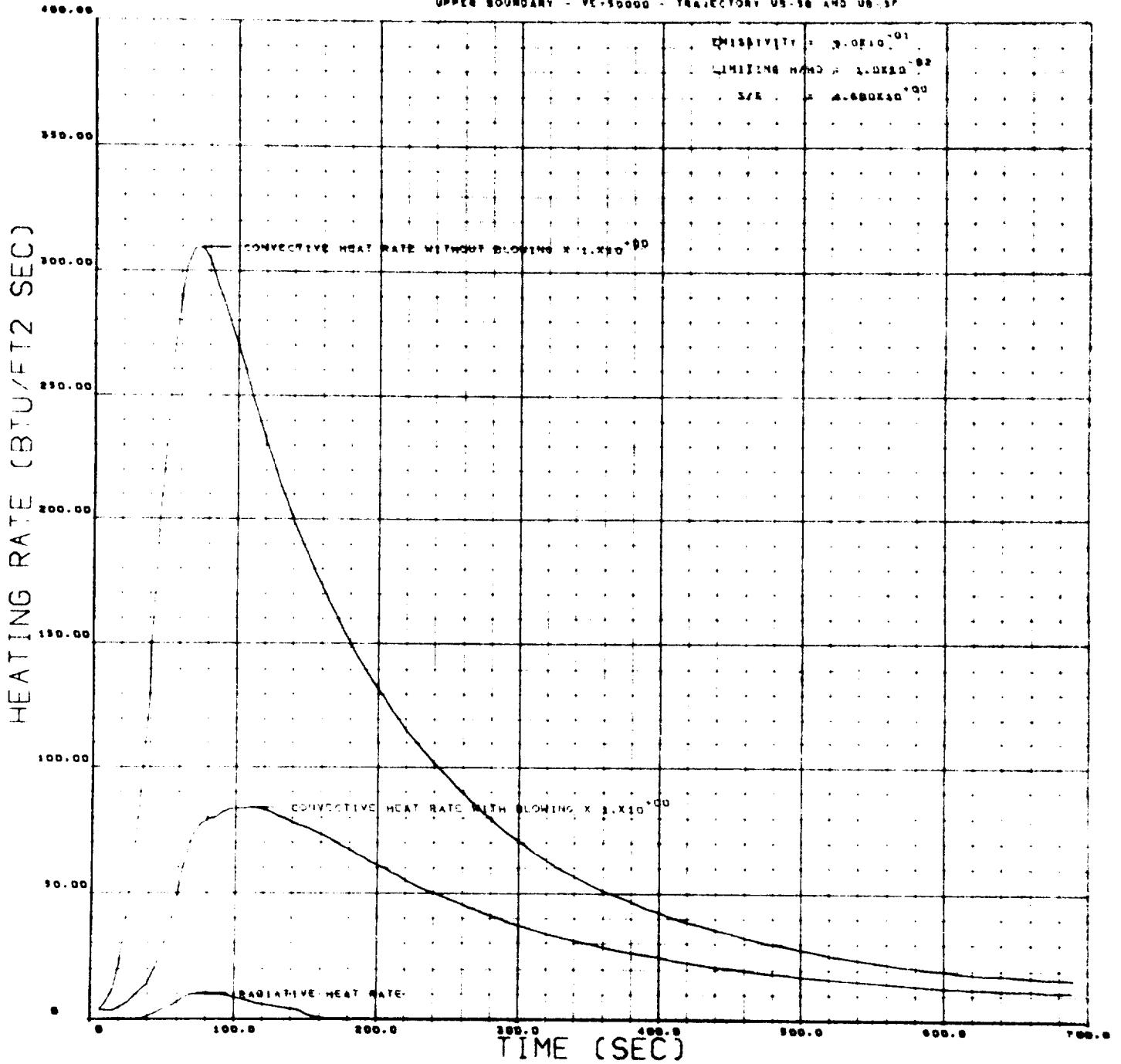


FIGURE 052

MATERIAL RESPONSE DATA

UPPER BOUNDARY - VE-50500 - TRAJECTORY US-30 AND US-37

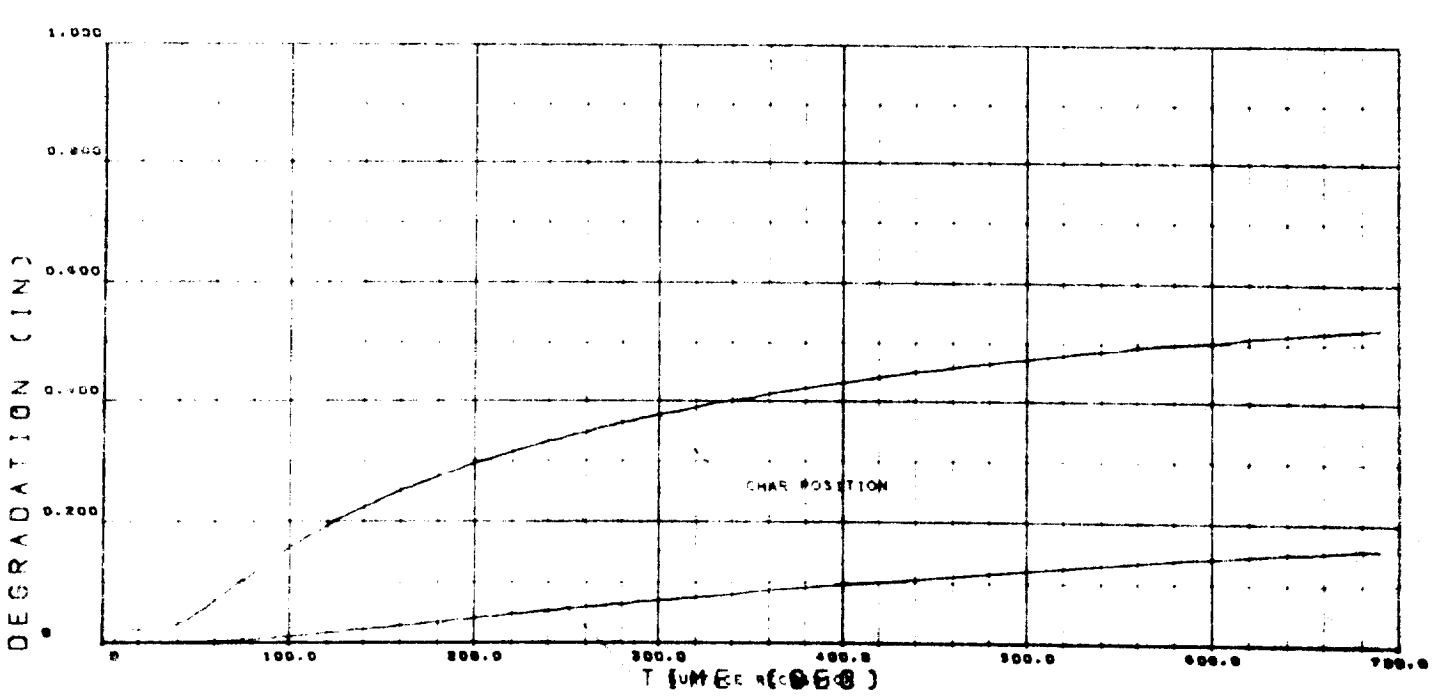
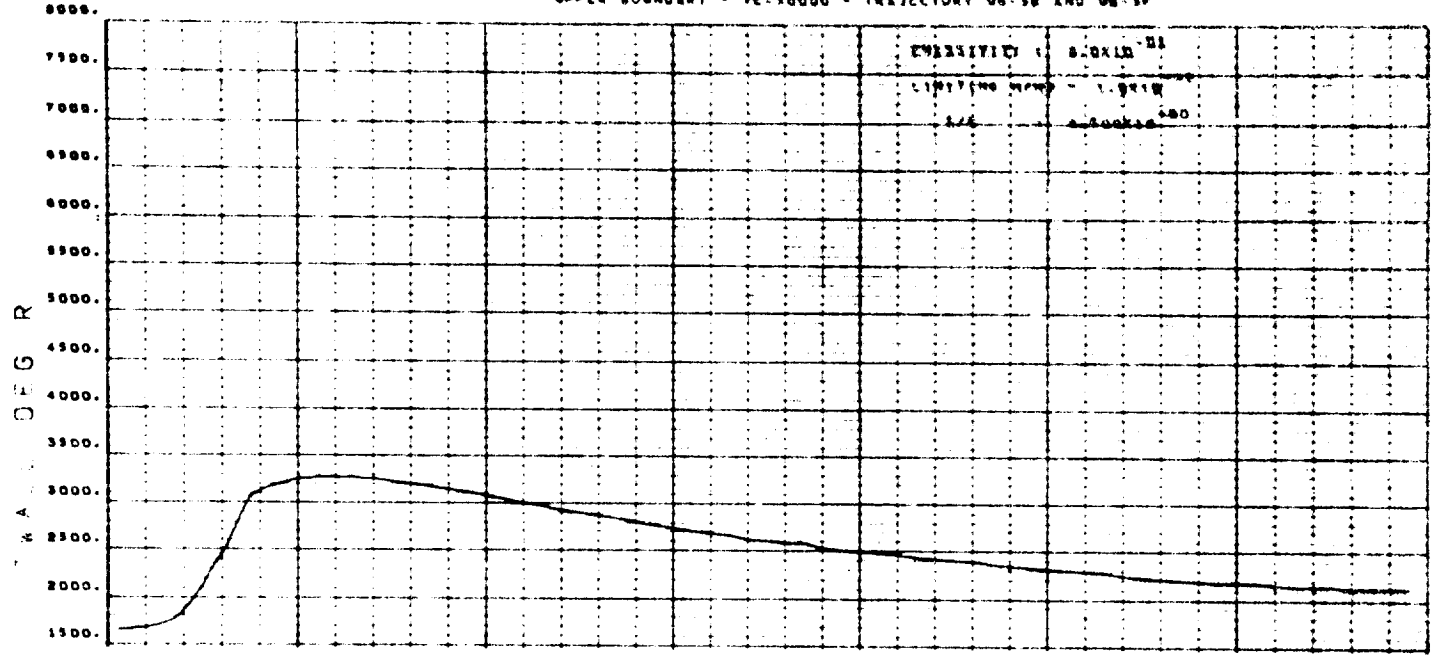


FIGURE B52

ENERGY ACCOMMODATION MECHANISMS

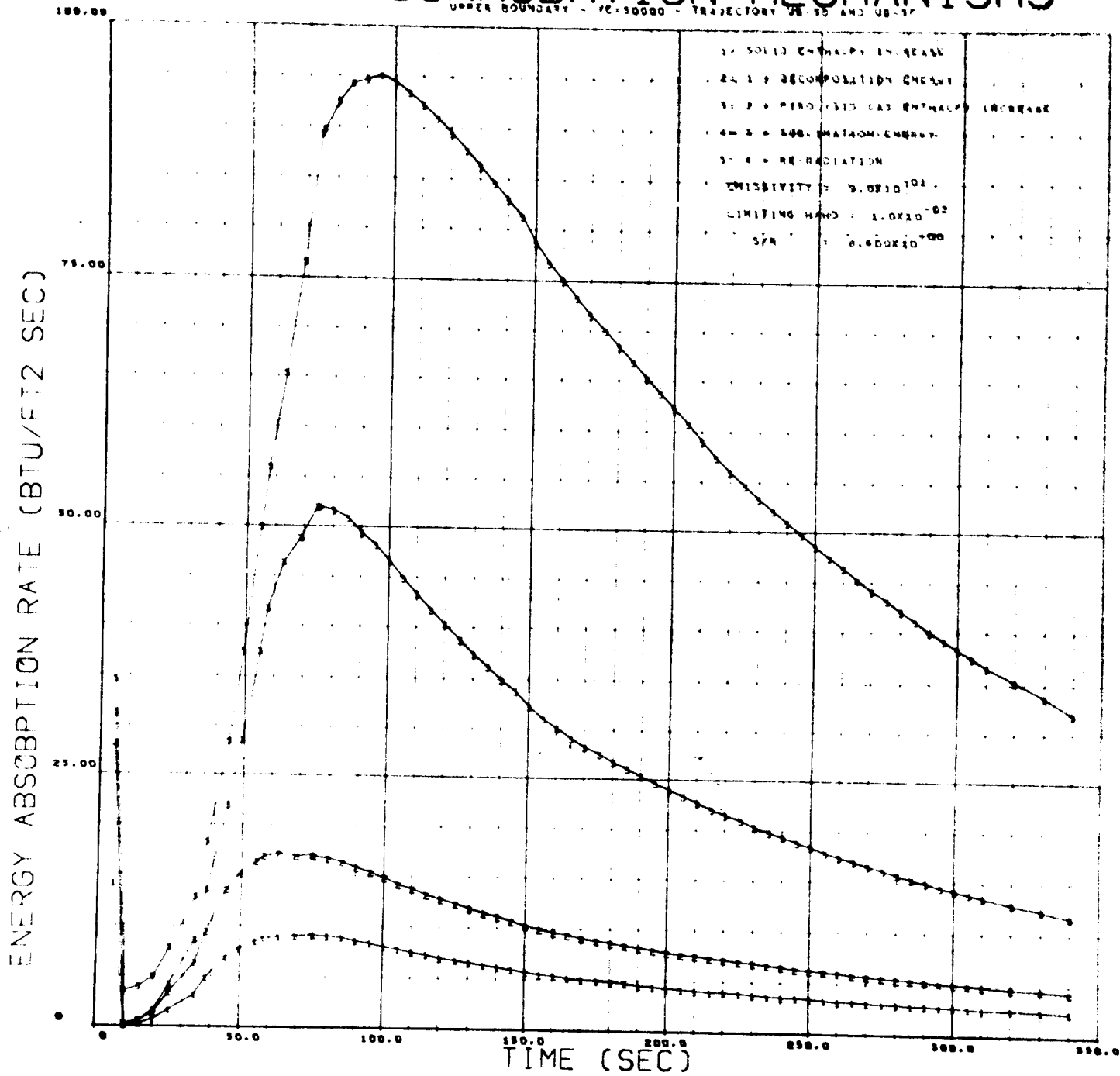


FIGURE B53

HEATING RATE HISTORY

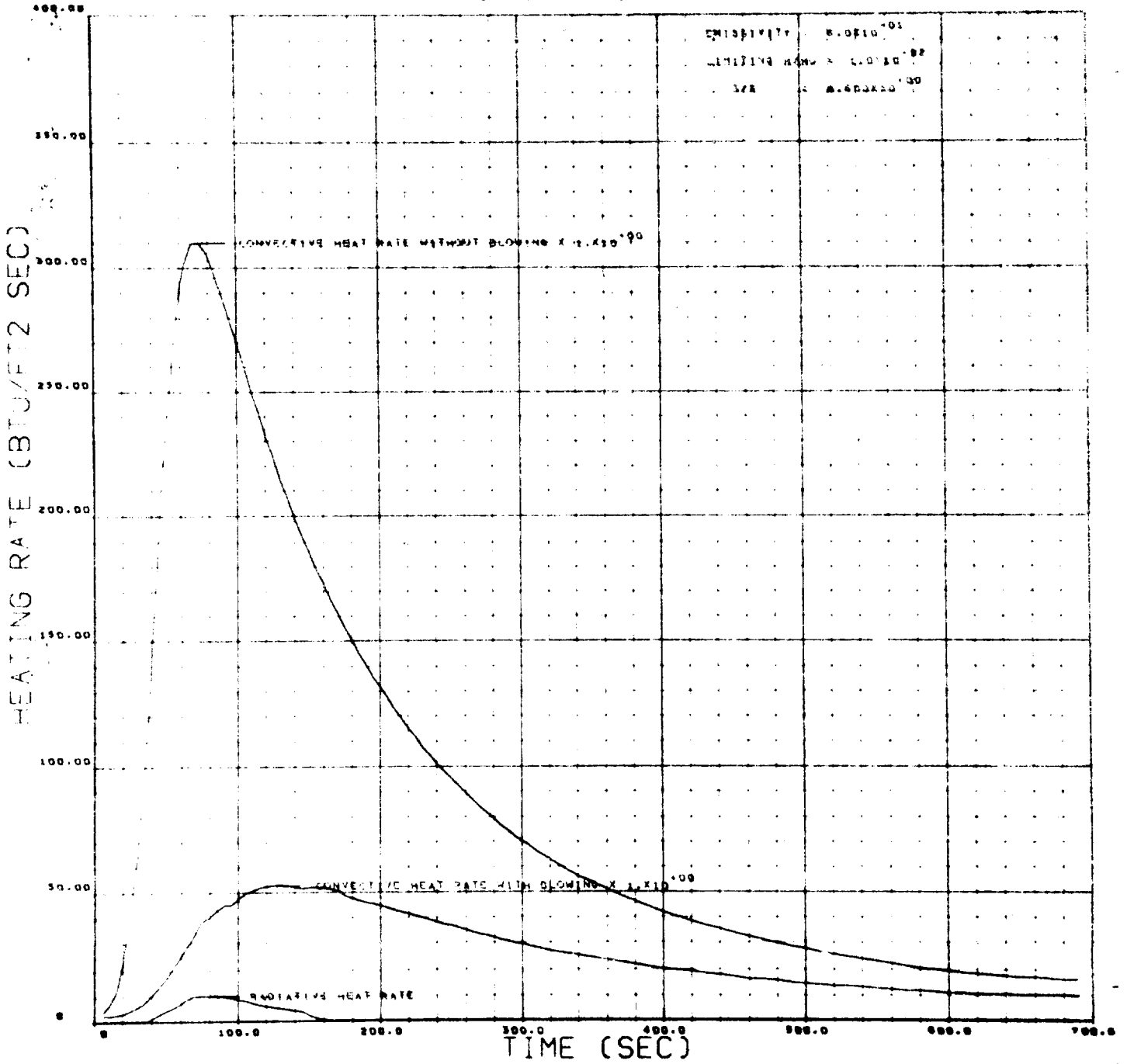
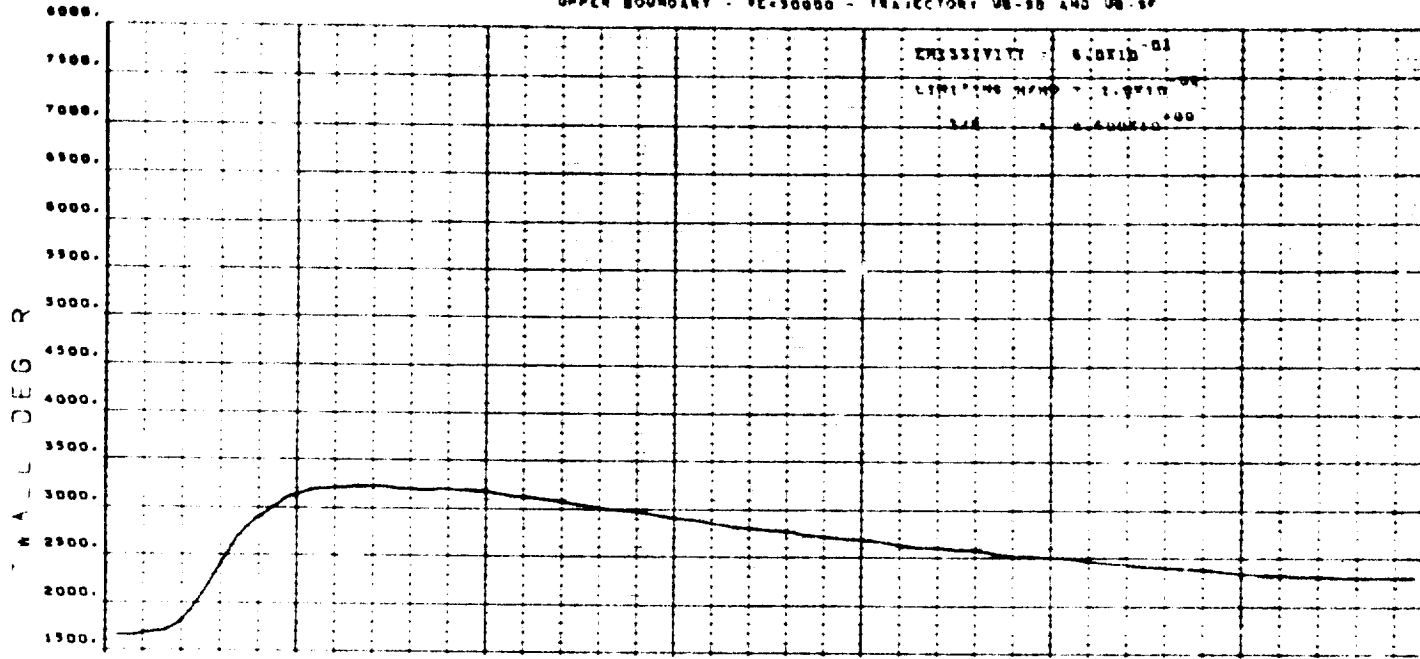


FIGURE B53

MATERIAL RESPONSE DATA

UPPER BOUNDARY - VE-30000 - TRAJECTORY 06-50 AND 06-57



EMISSIVITY 0.0710-01
LIMITING HEAT FLUX 1.0010-00
TIME 0.00000-000

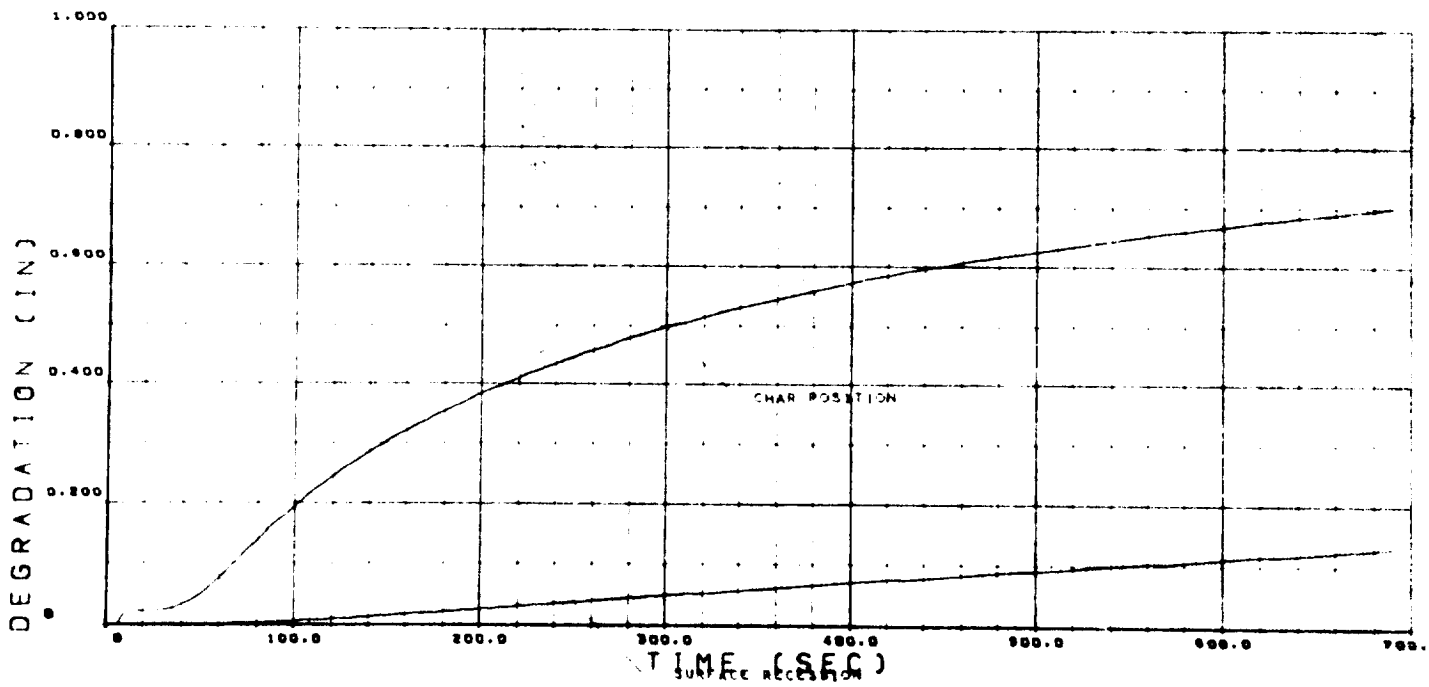


FIGURE 853

ENERGY ACCOMMODATION MECHANISMS

JAPEN BOUNDARY - VE=10000 - TRAJECTORY 05-98 AND 00-97

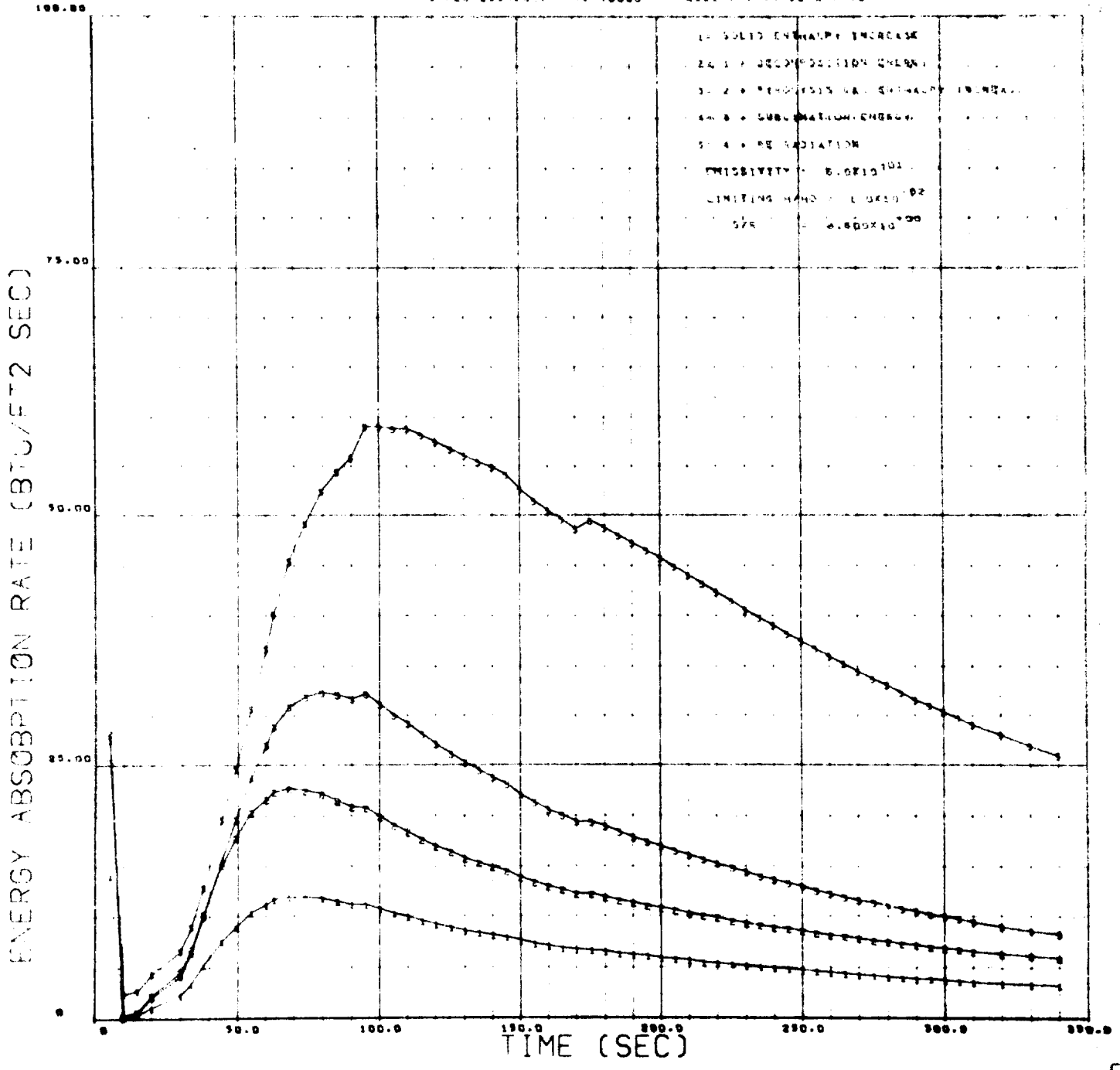


FIGURE B54

HEATING RATE HISTORY

UPPER BOUNDARY - Y=50000 - TRAJECTORY UB-38 AND UB-37

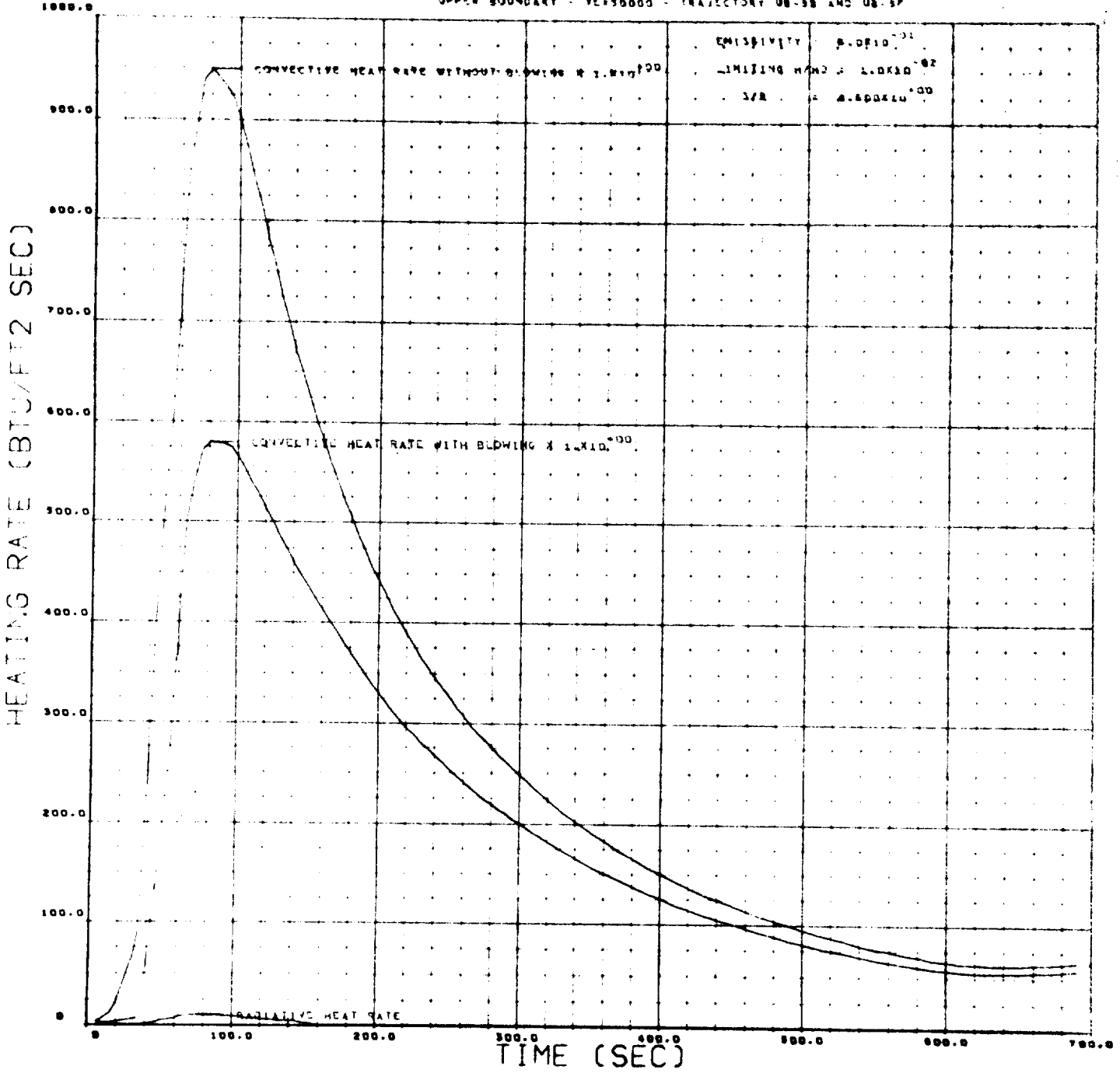


FIGURE 654

MATERIAL RESPONSE DATA

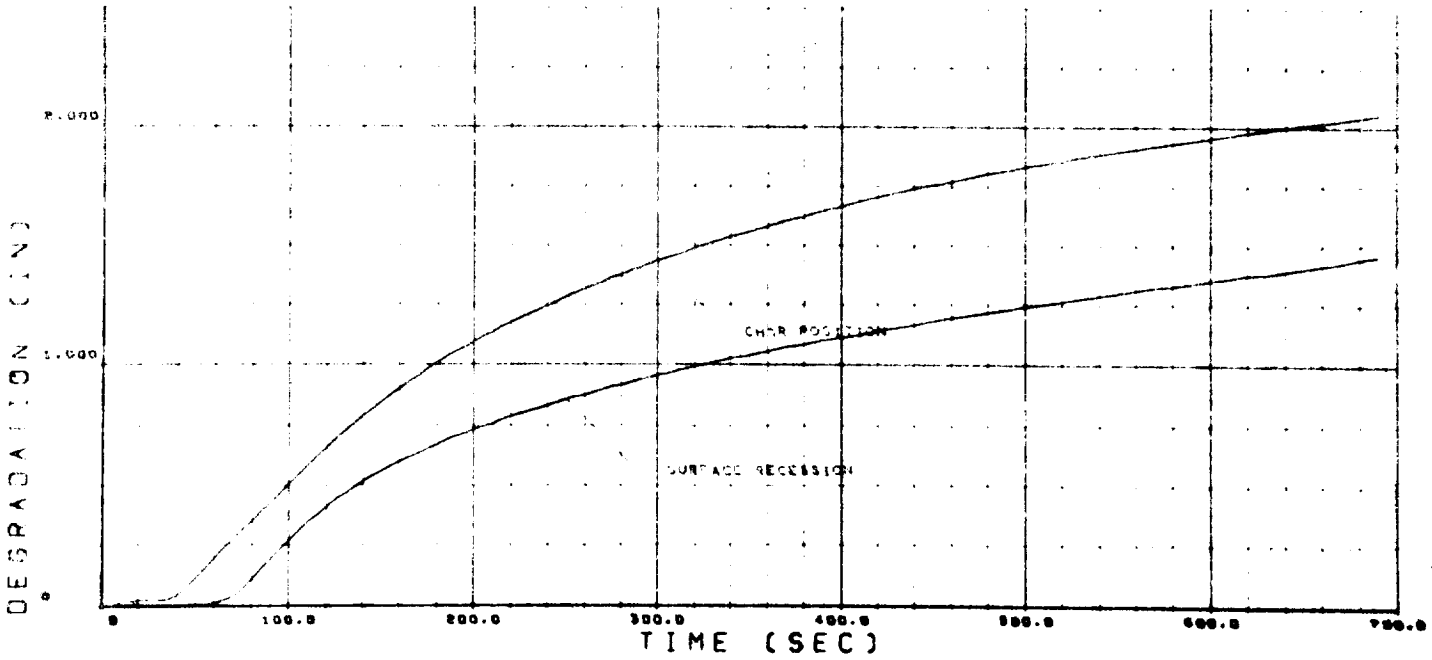
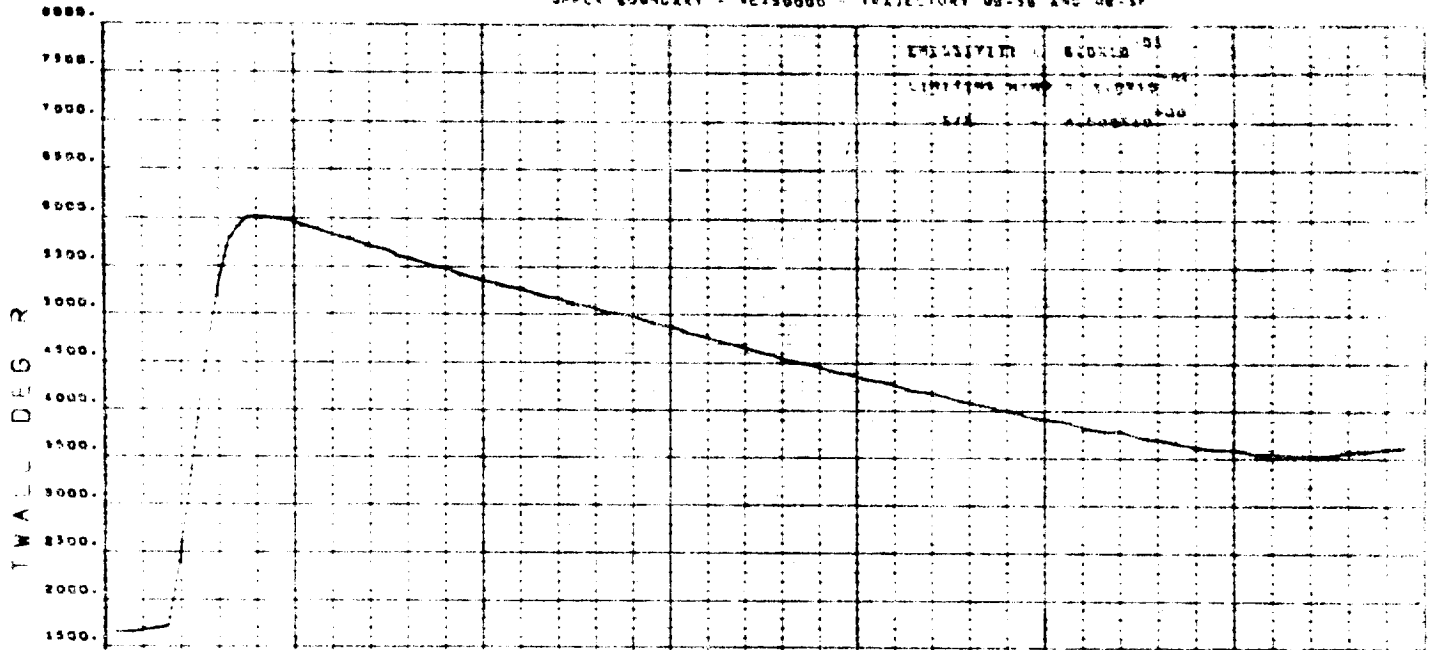


FIGURE 1854

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VE=10000 - TRAJECTORY US-38 AND US-37

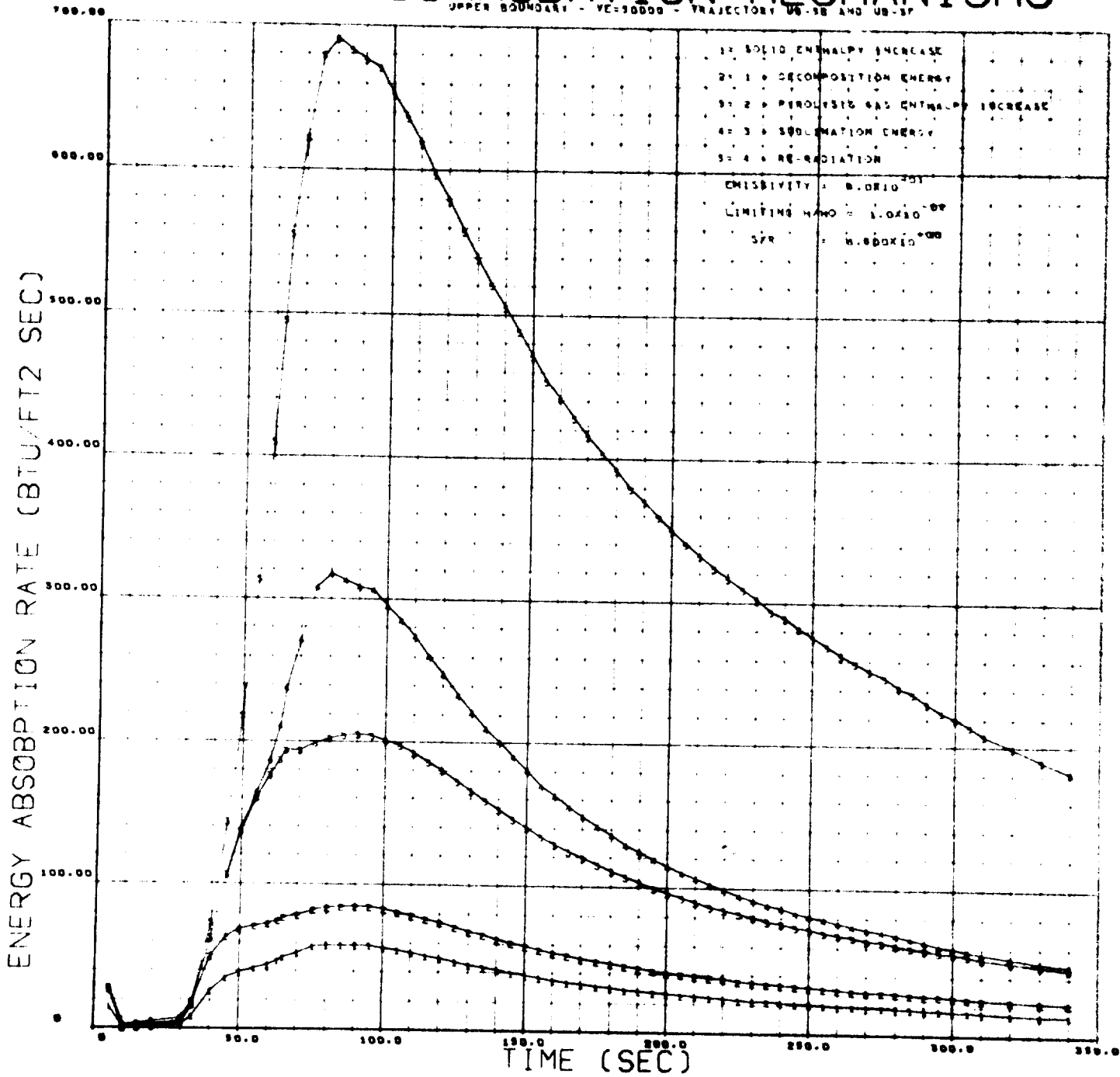


FIGURE B.55

HEATING RATE HISTORY

UPPER BOUNDARY - VE-570CB - TRAJECTORY US-65 AND US-67

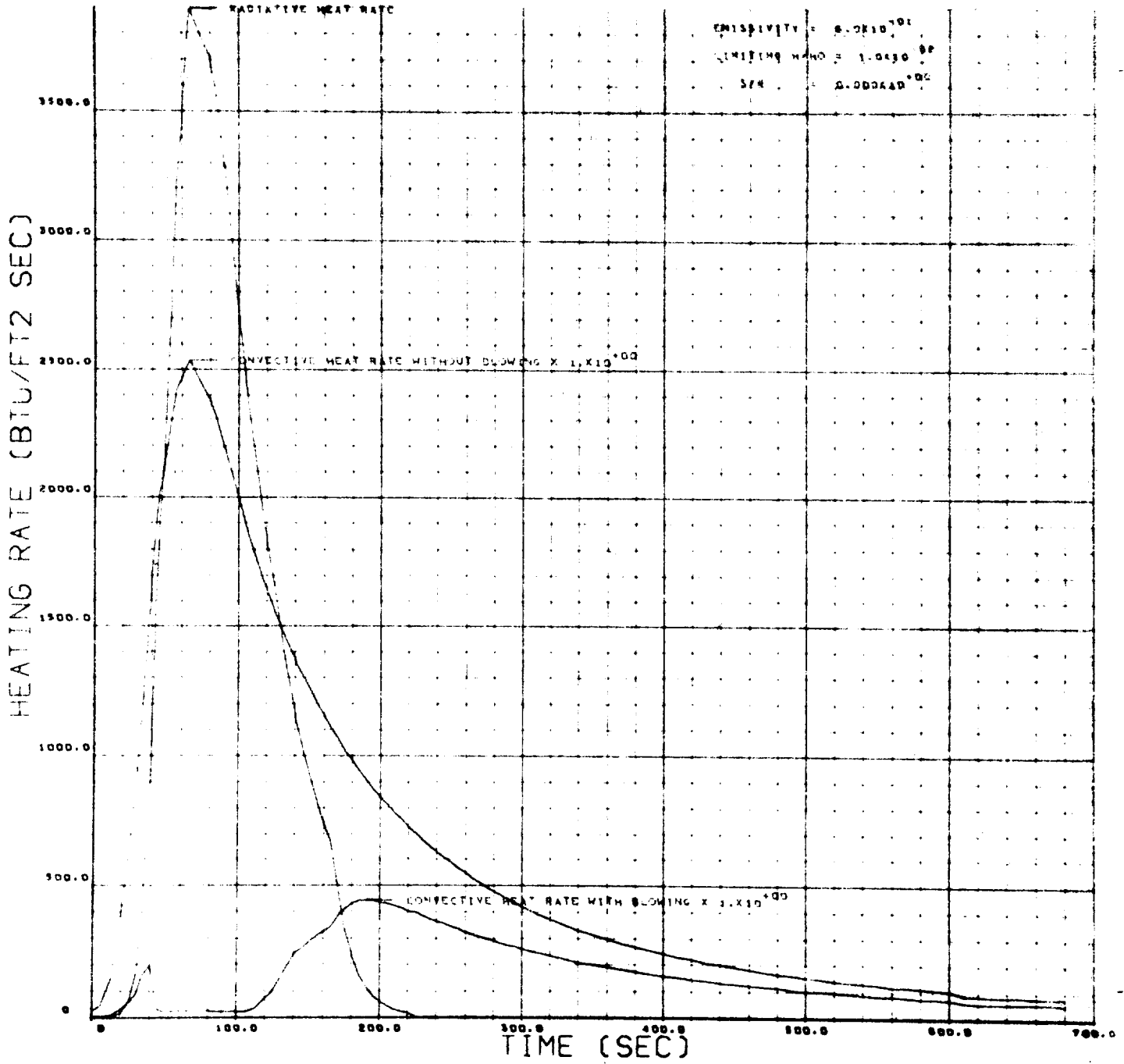


FIGURE B55

MATERIAL RESPONSE DATA

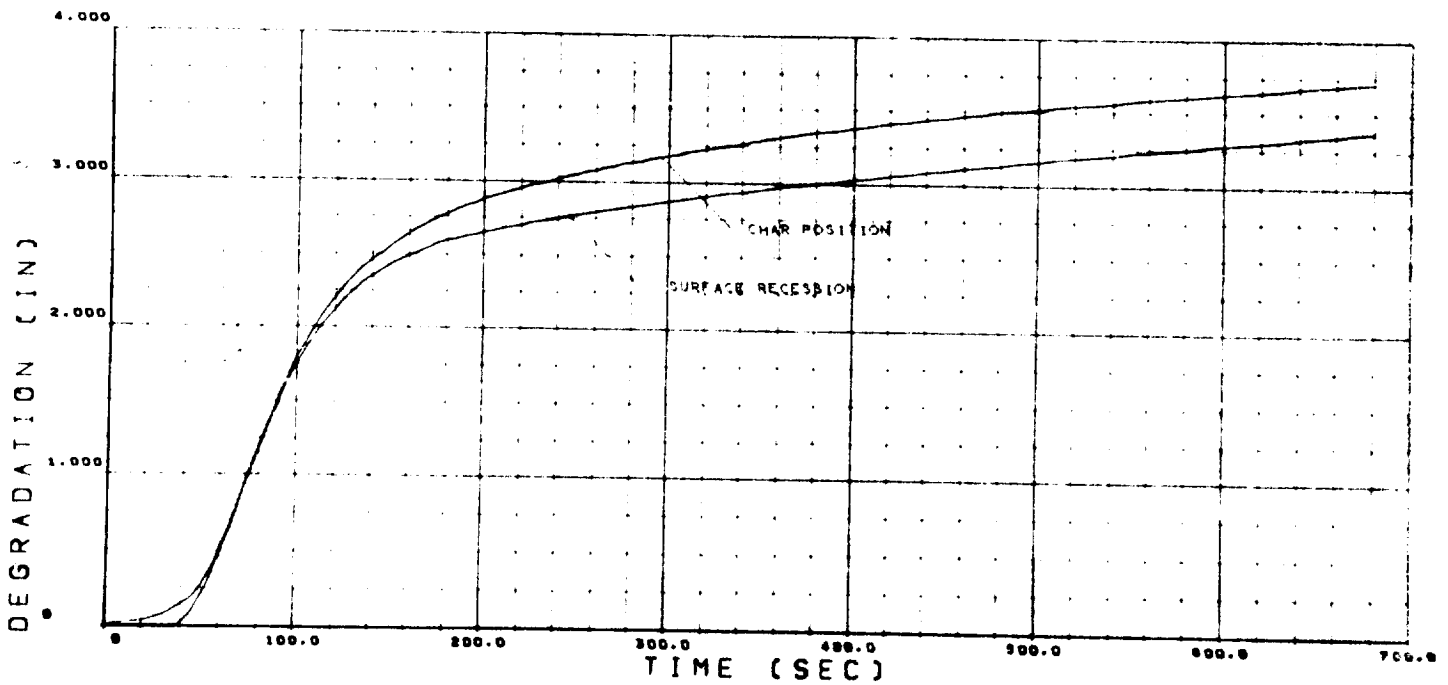
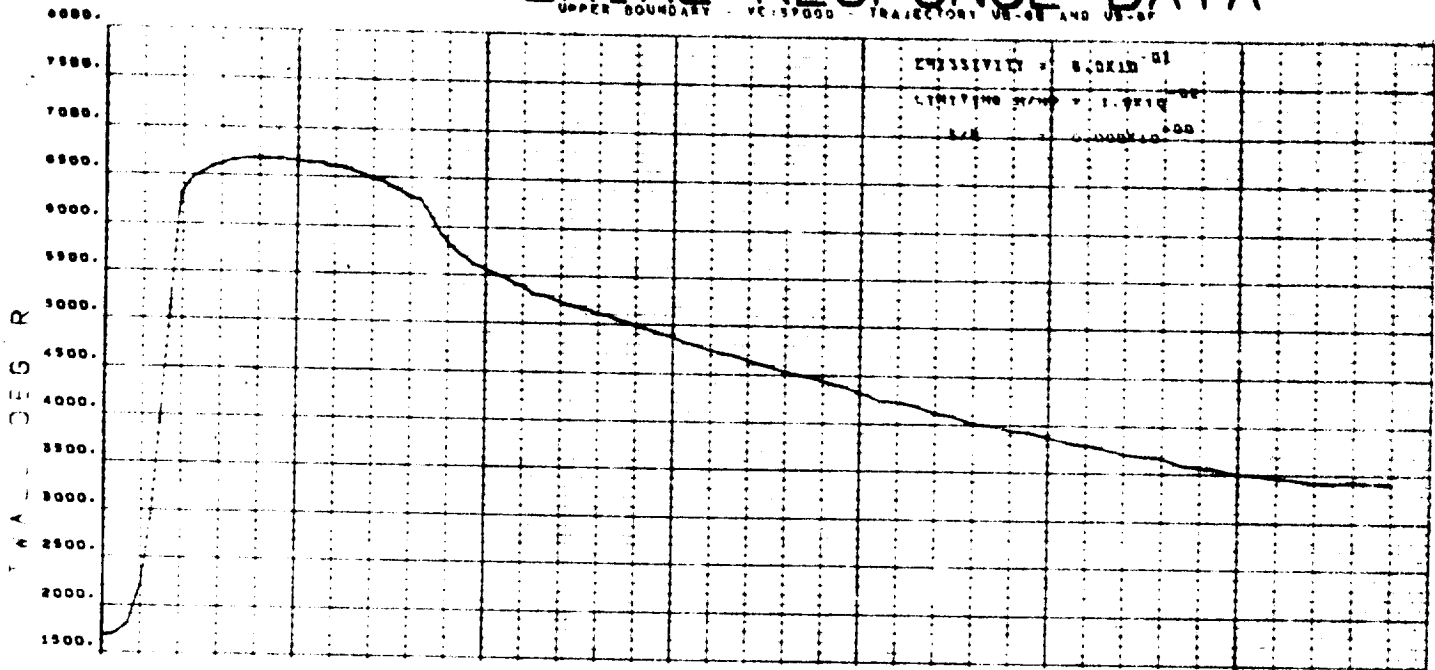


FIGURE B55

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VE=37500 - TRAJECTORY UB-88 AND UB-87

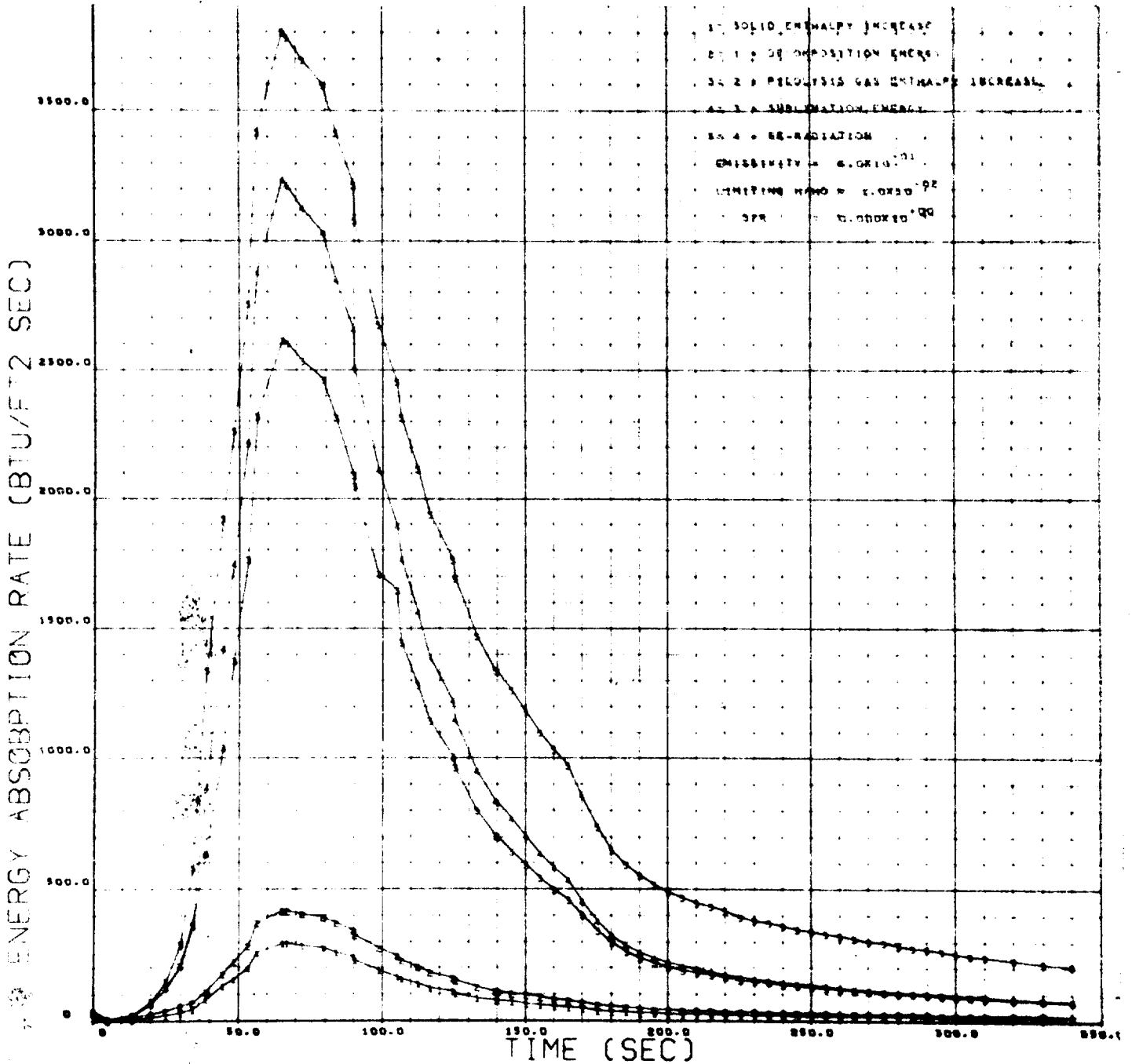


FIGURE B 56

HEATING RATE HISTORY

UPPER BOUNDARY - VE=5000 - TRAJECTORY UB-66 AND UB-67

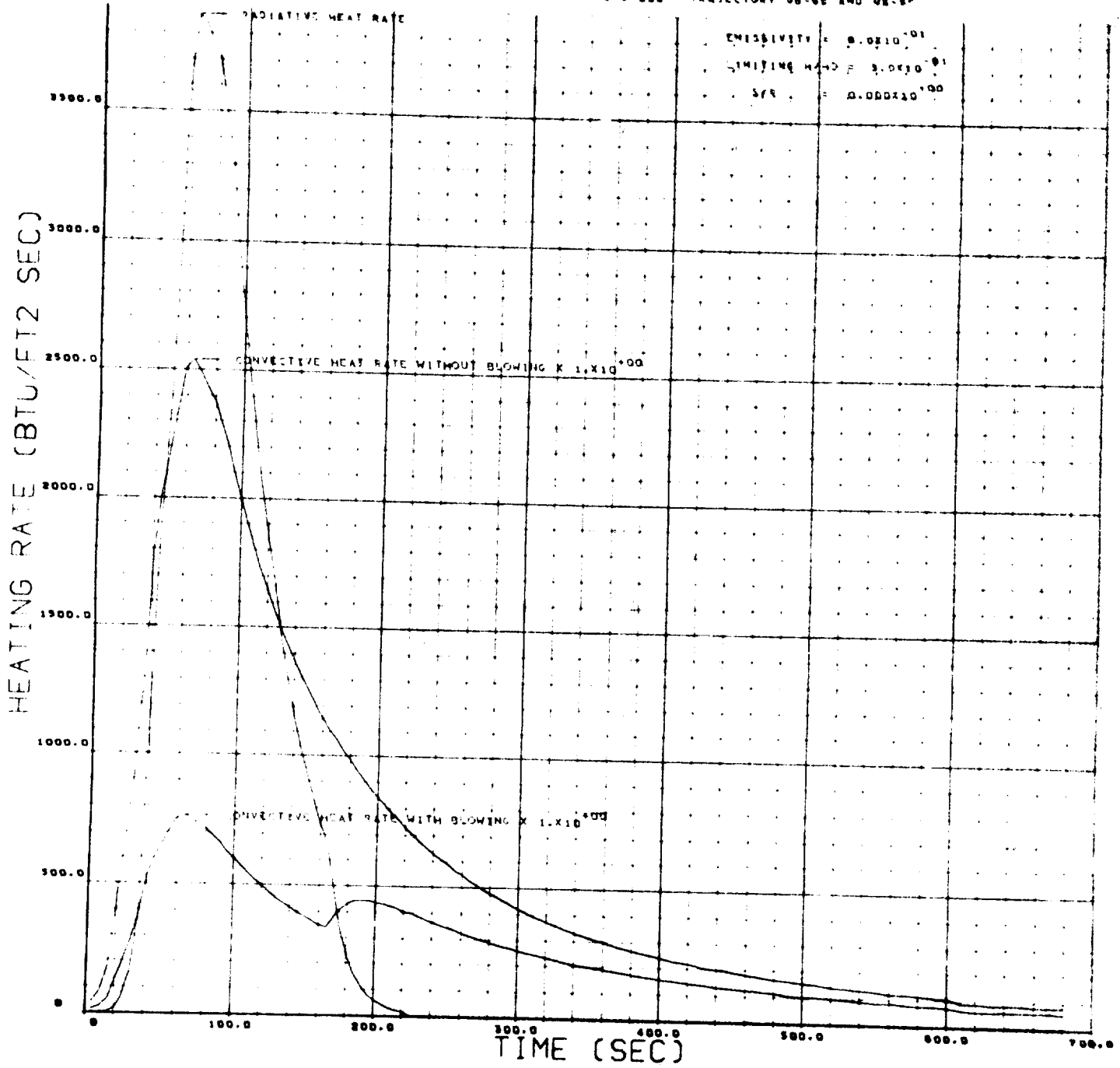


FIGURE B 56

MATERIAL RESPONSE DATA

UPPER BOUNDARY VE=57000 - TRAJECTORY US-87 AND US-87

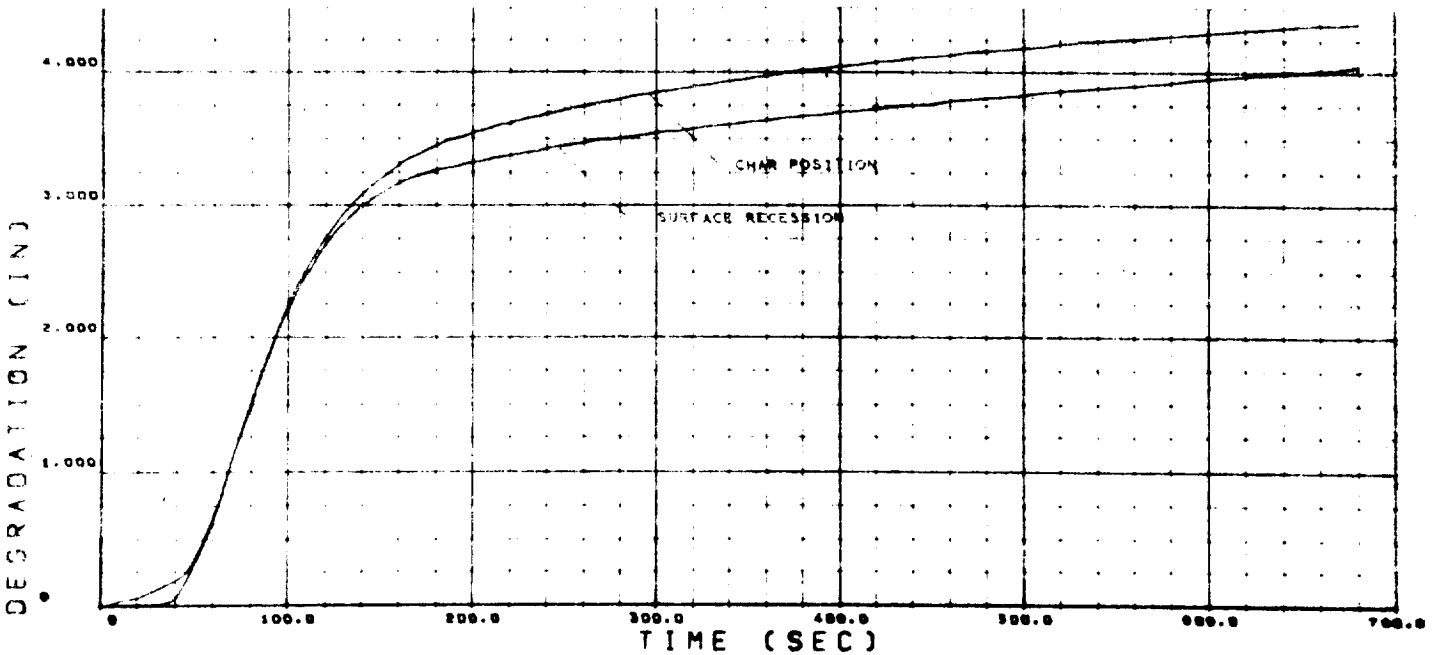
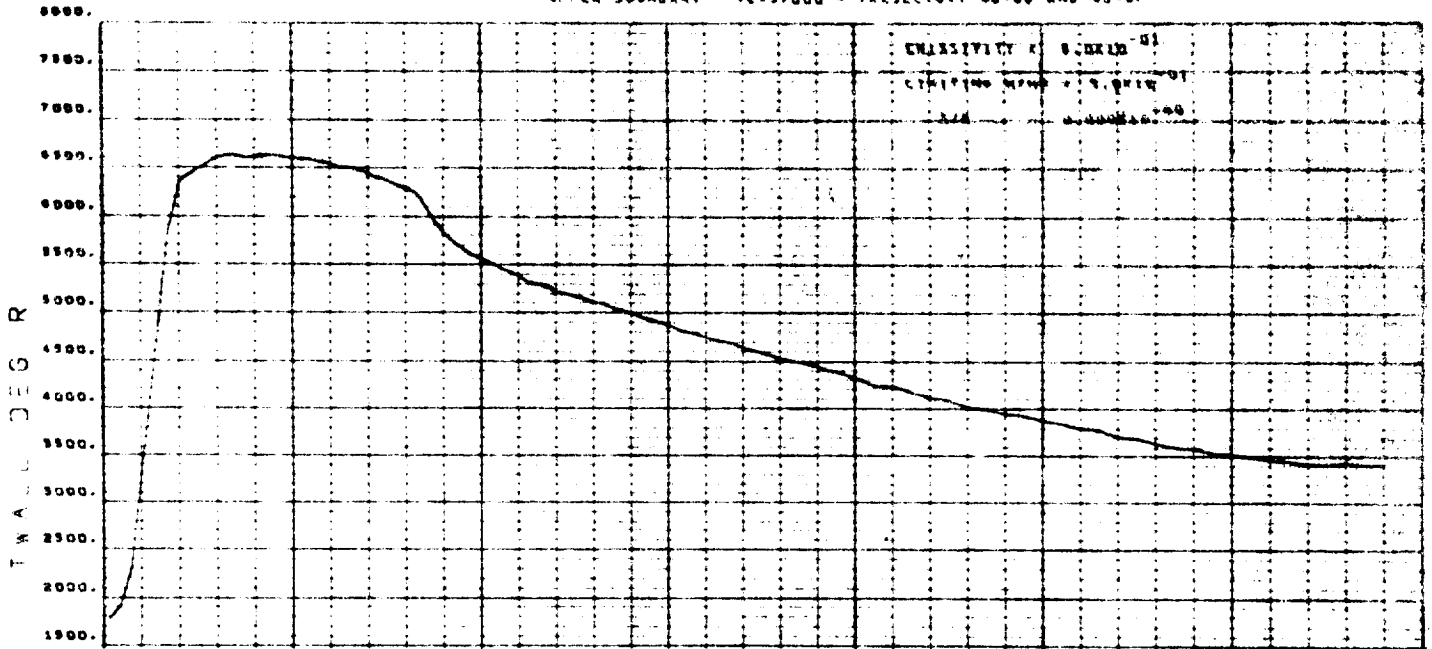


FIGURE B56

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VELOCITY - TRAJECTORY 08-05 AND 08-07

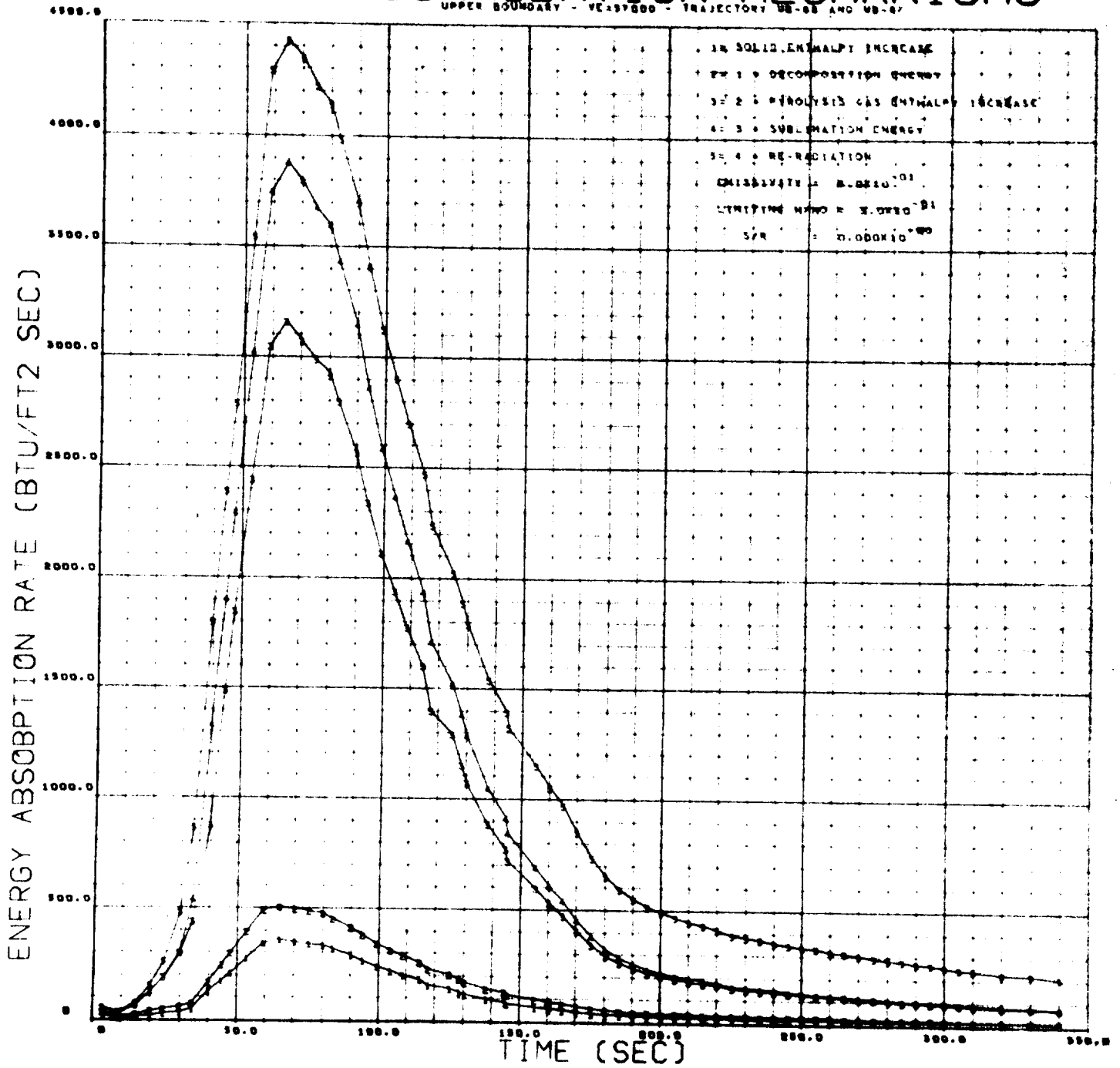


FIGURE B 57

HEATING RATE HISTORY

UPPER BOUNDARY VELOCITY TRAJECTORY 35-48 AND 48-57

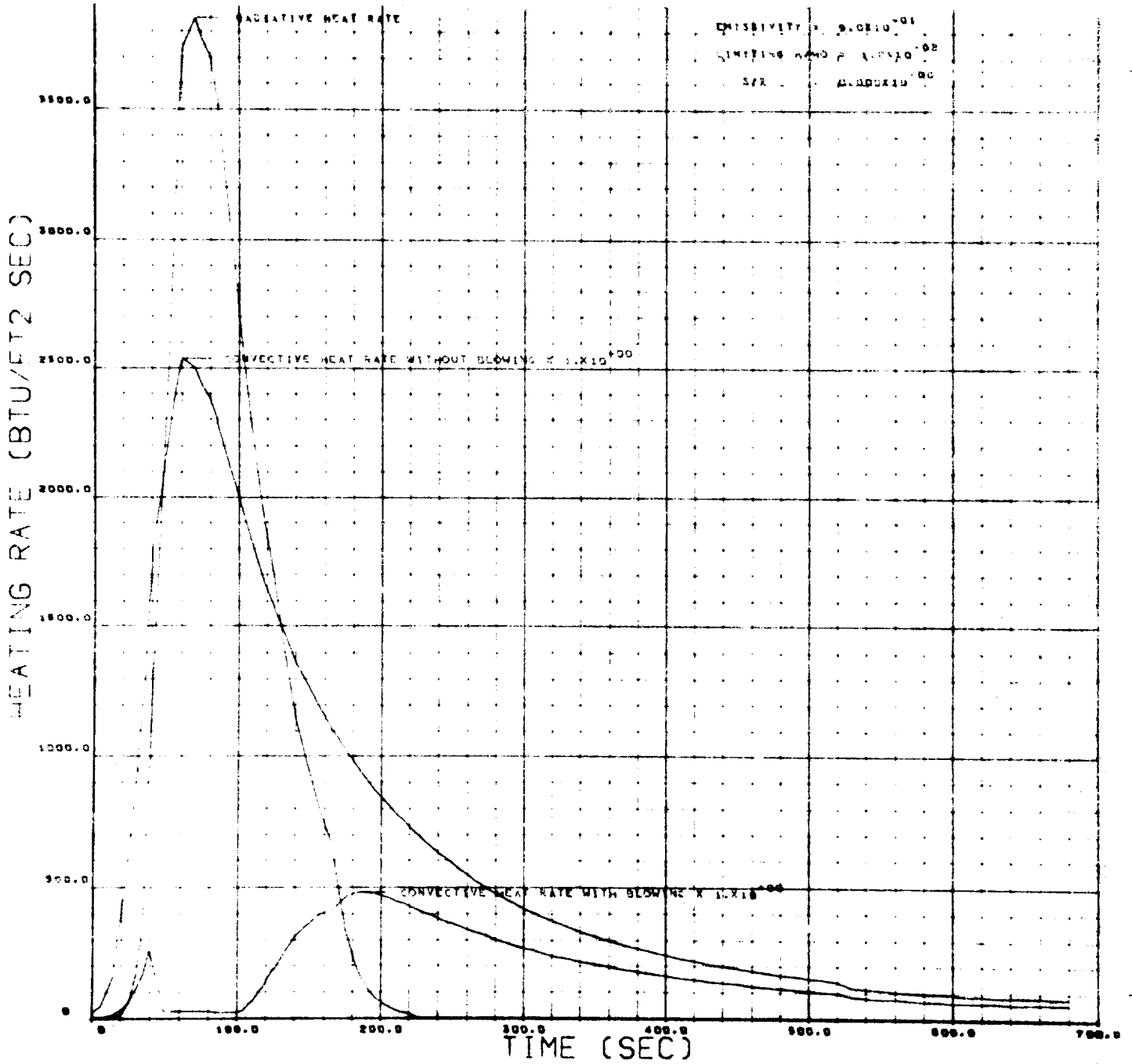


FIGURE B.57

MATERIAL RESPONSE DATA

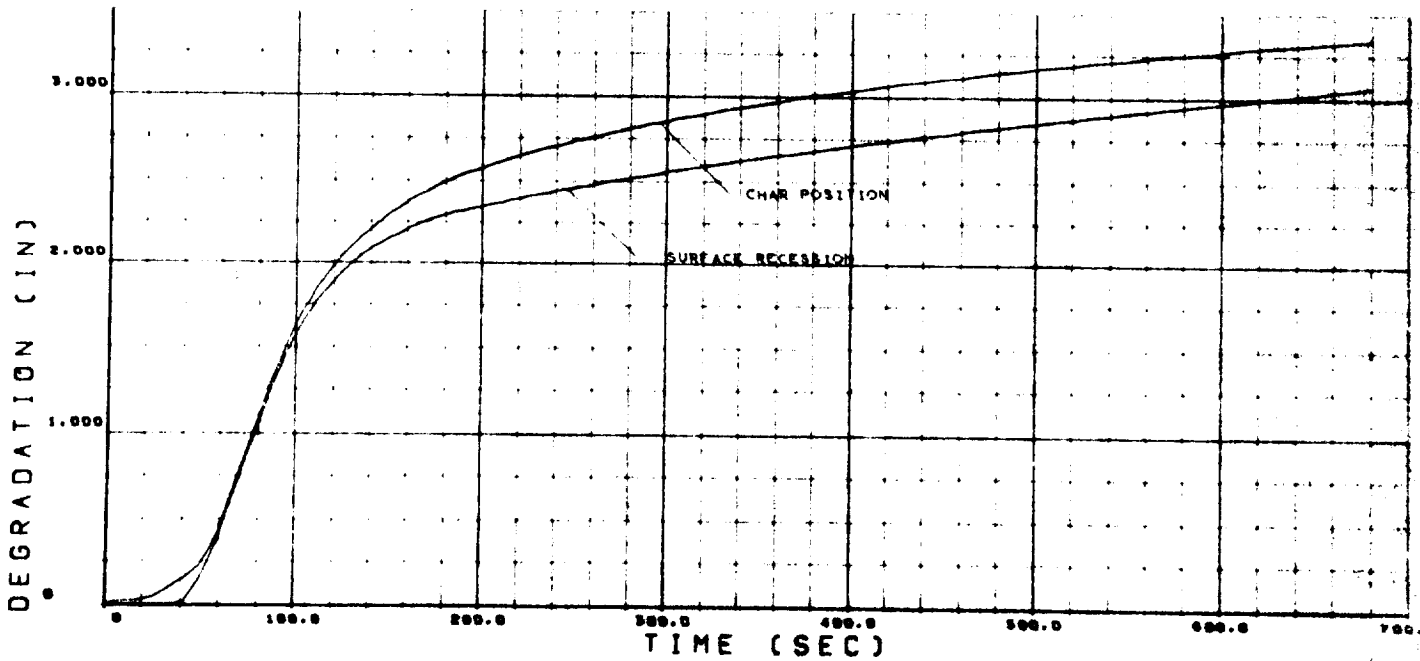
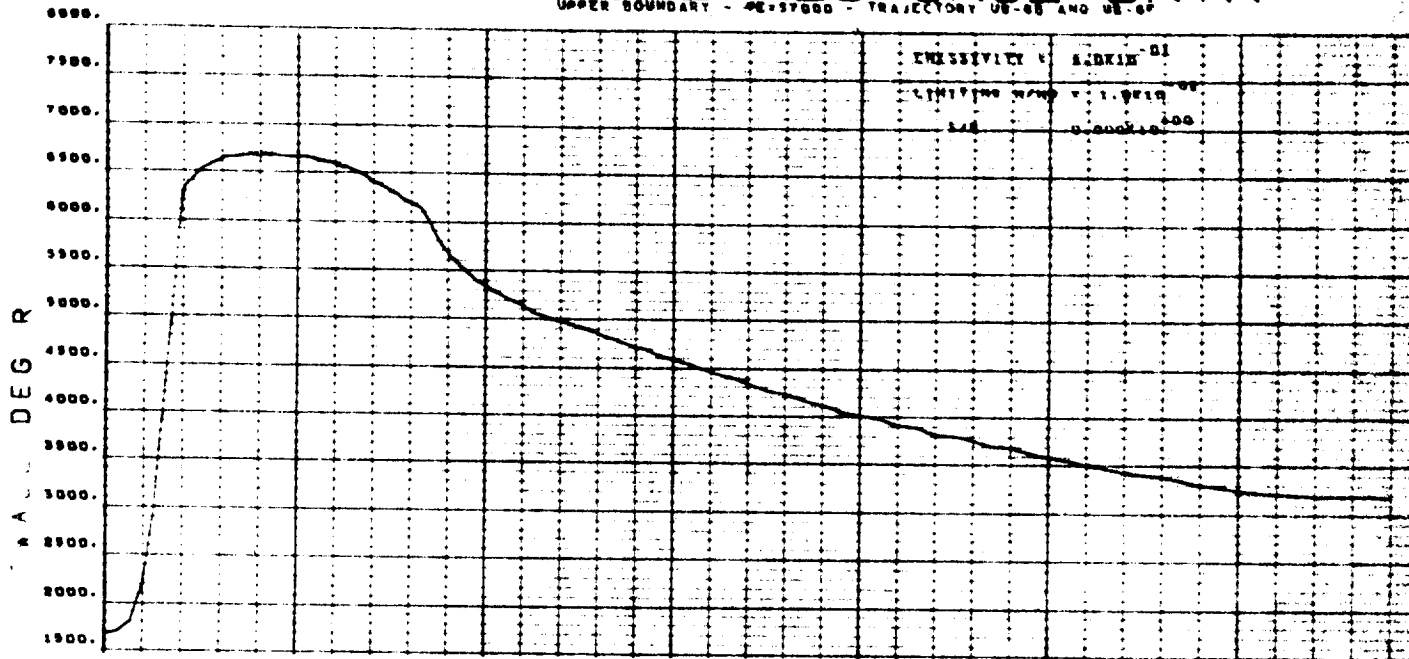


FIGURE B57

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VE=57000 - TRAJECTORY US-68 AND US-67

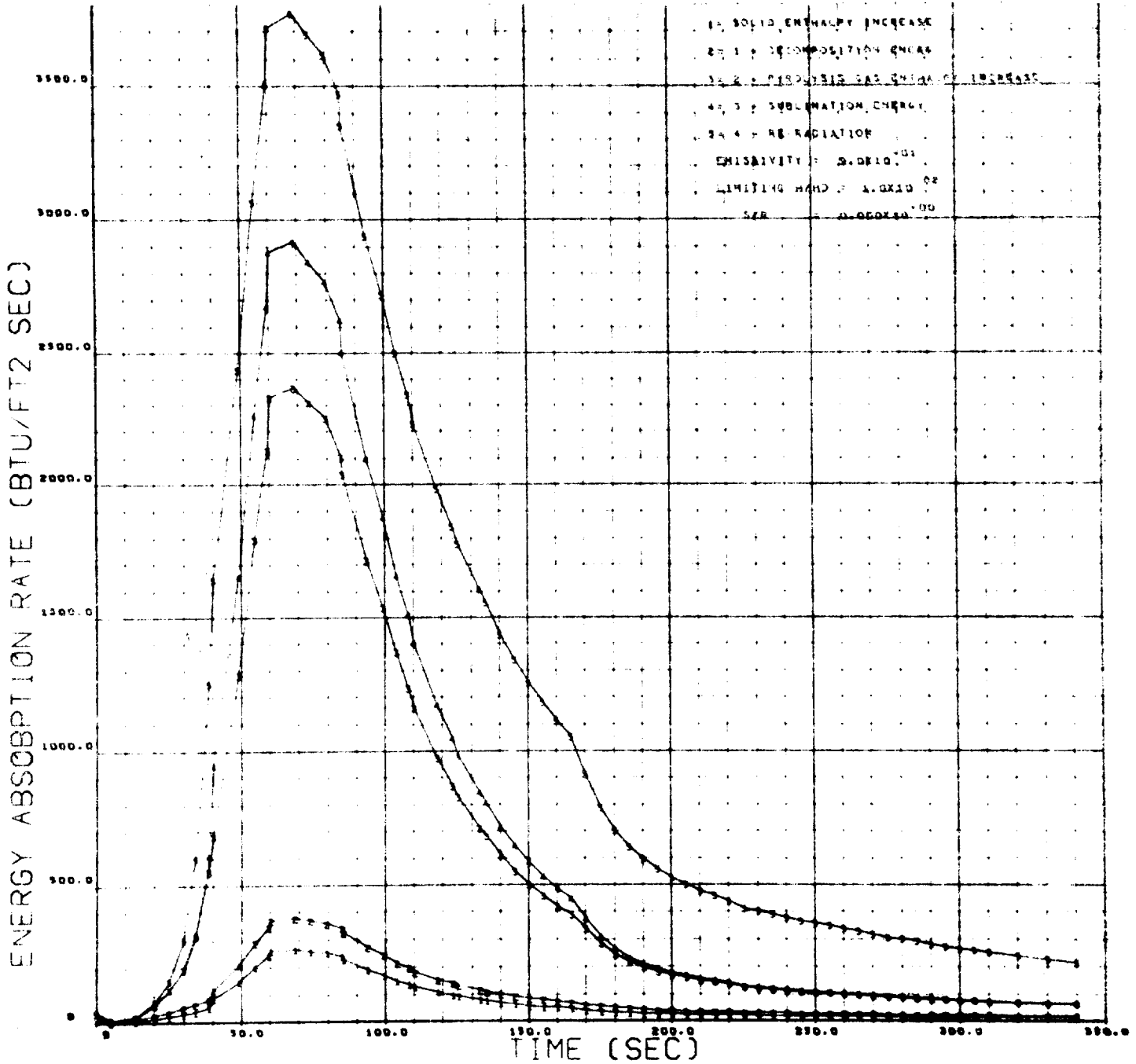


FIGURE B 53

HEATING RATE HISTORY

UPPER BOUNDARY - VC-59009 - TRAJECTORY US-88 AND US-87

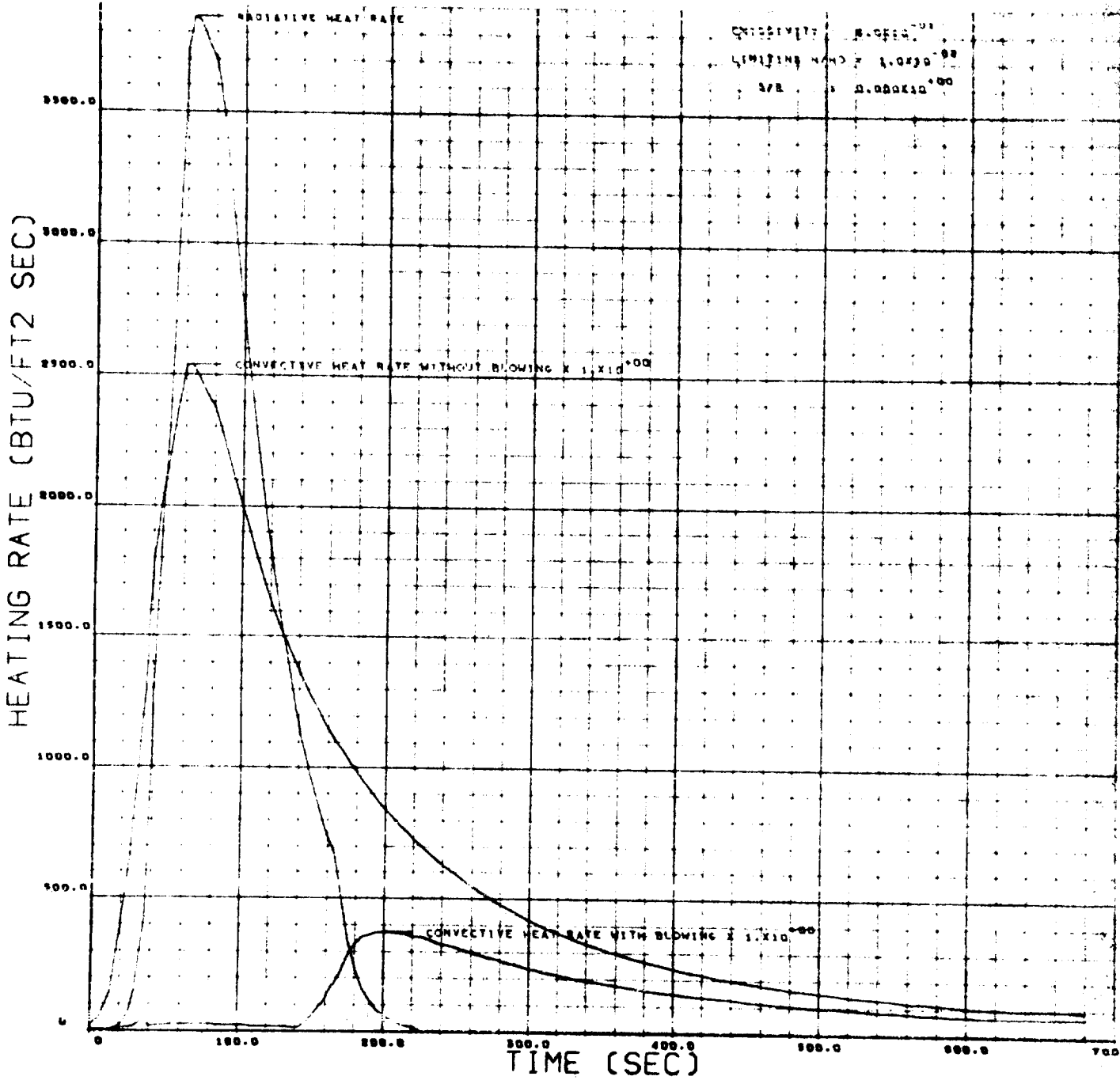


FIGURE B 58

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VE=37000 - TRAJECTORY UB-65 AND UB-67

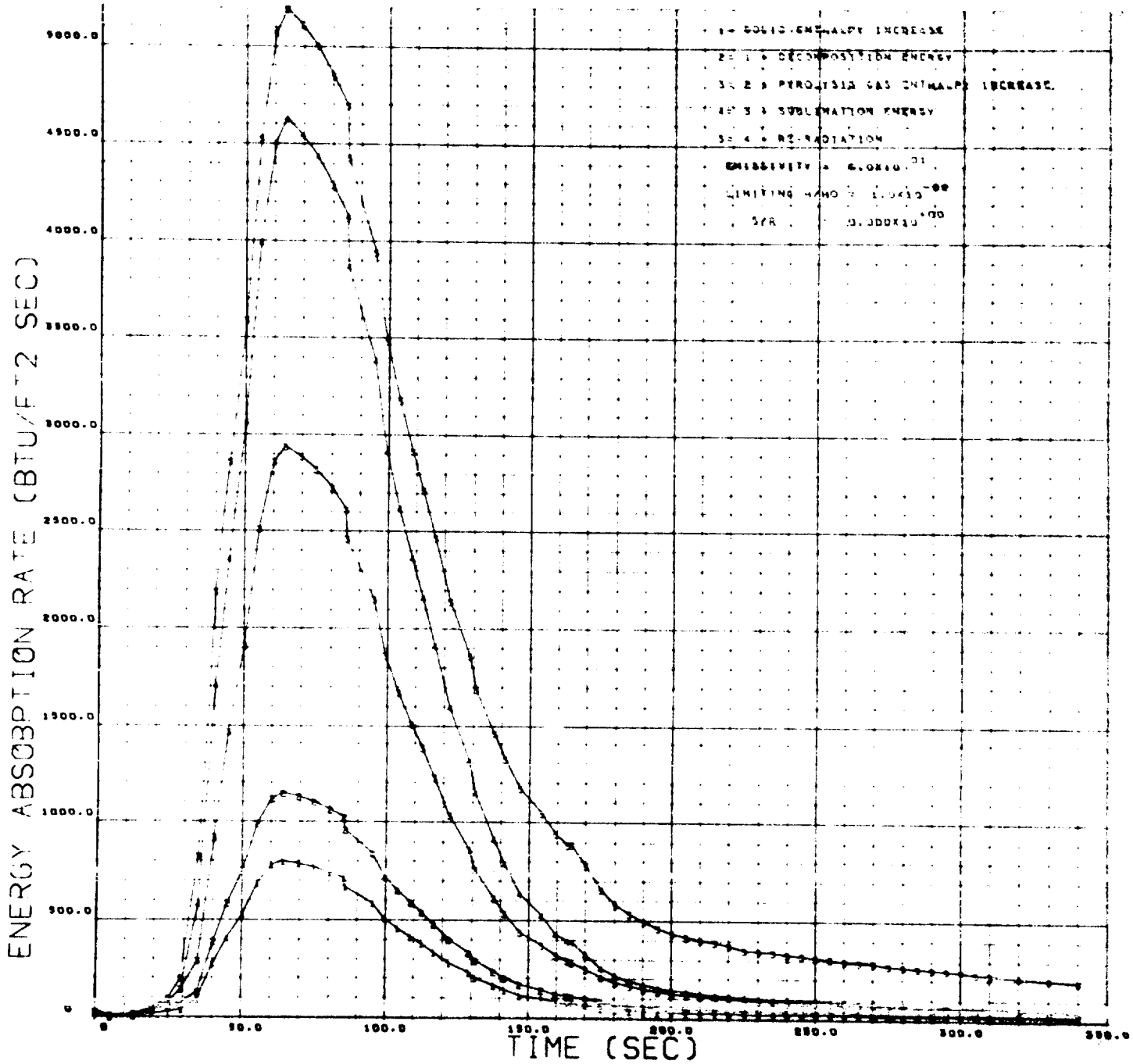


FIGURE B-59

HEATING RATE HISTORY

UPPER BOUNDARY - TC:57500 - TRAJECTORY 25-88 AND 26-87

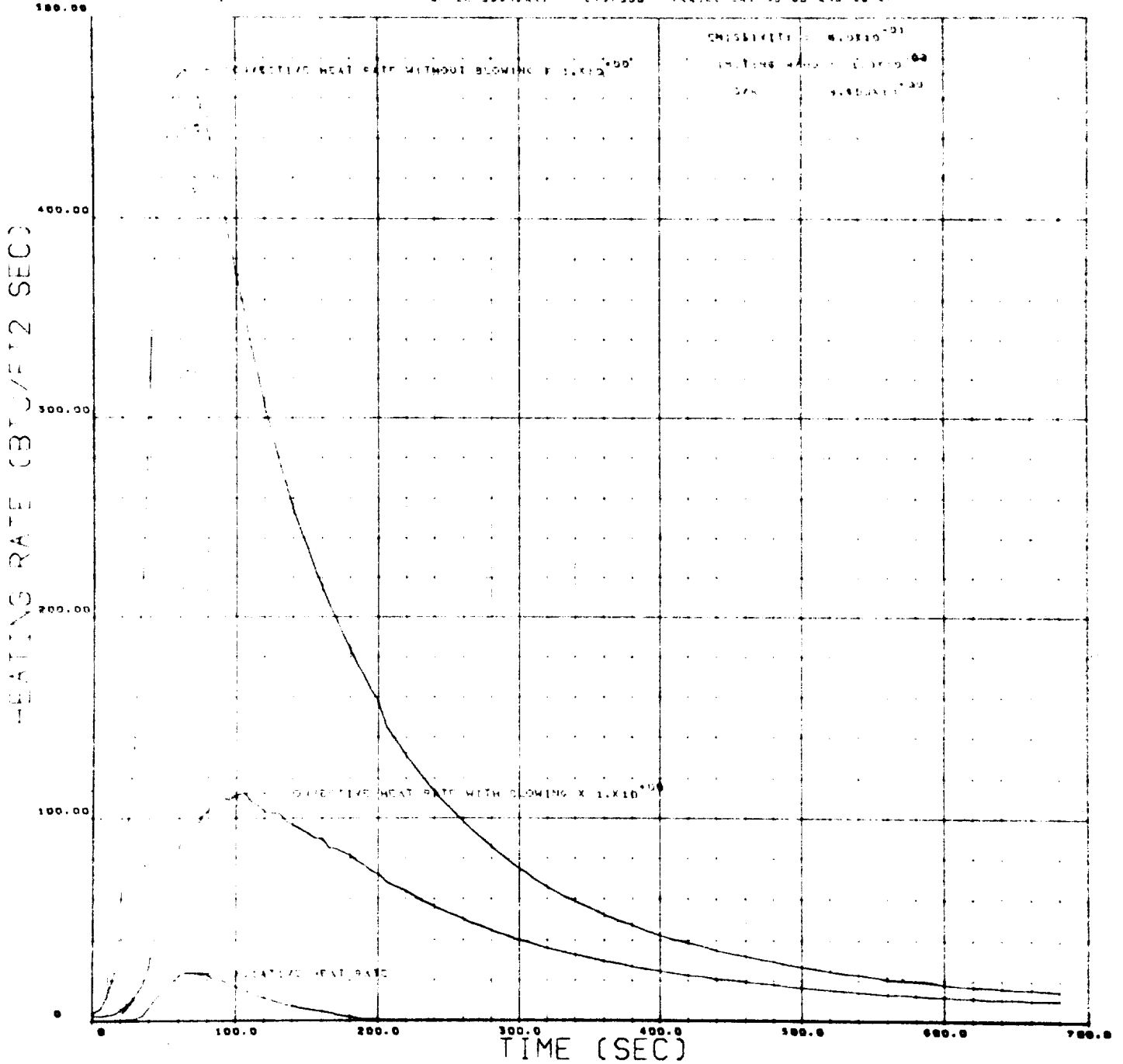


FIGURE 859

MATERIAL RESPONSE DATA

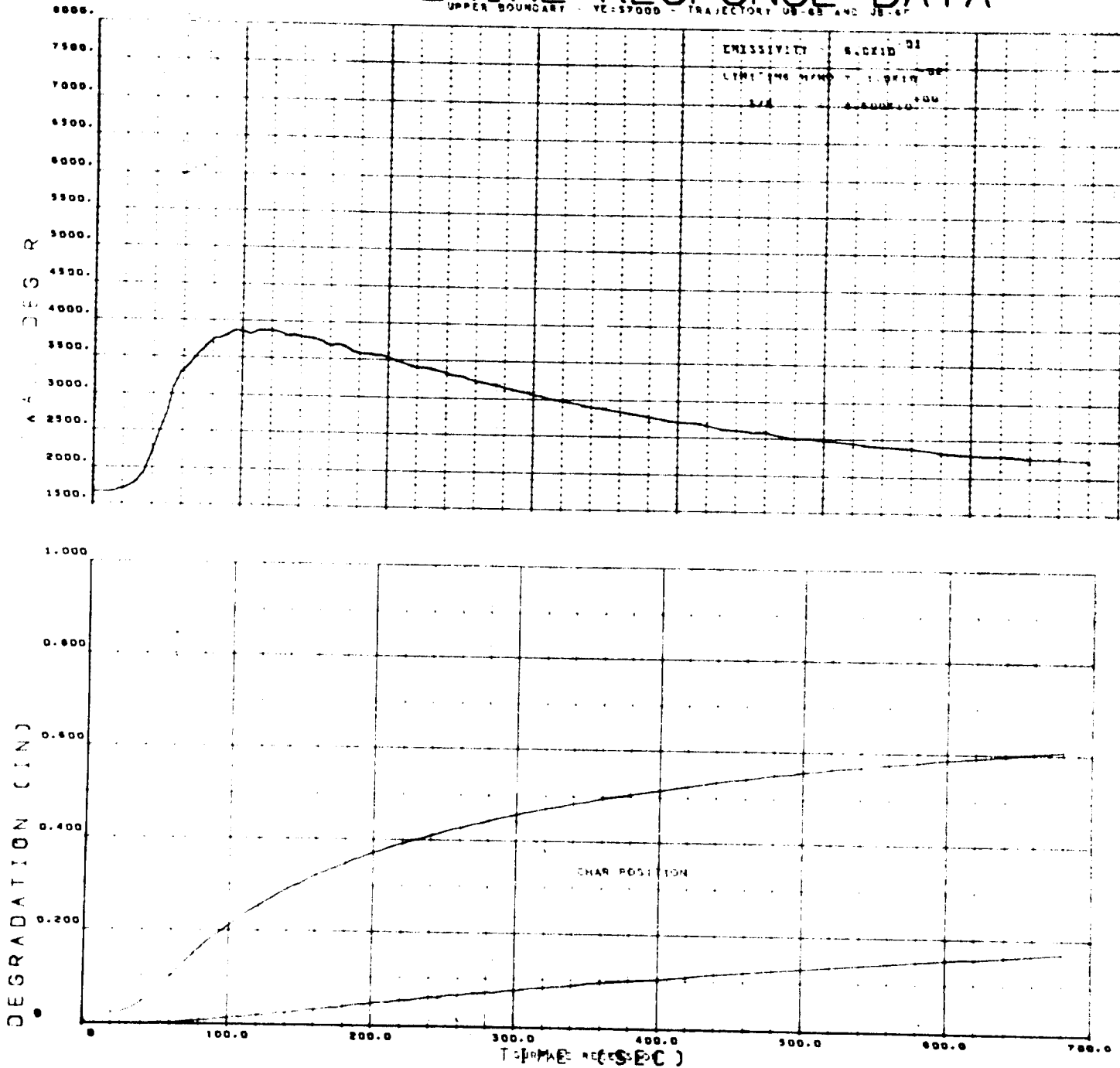


FIGURE B.59

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VC-57000 - TRAJECTORY DE-80 AND DE-87

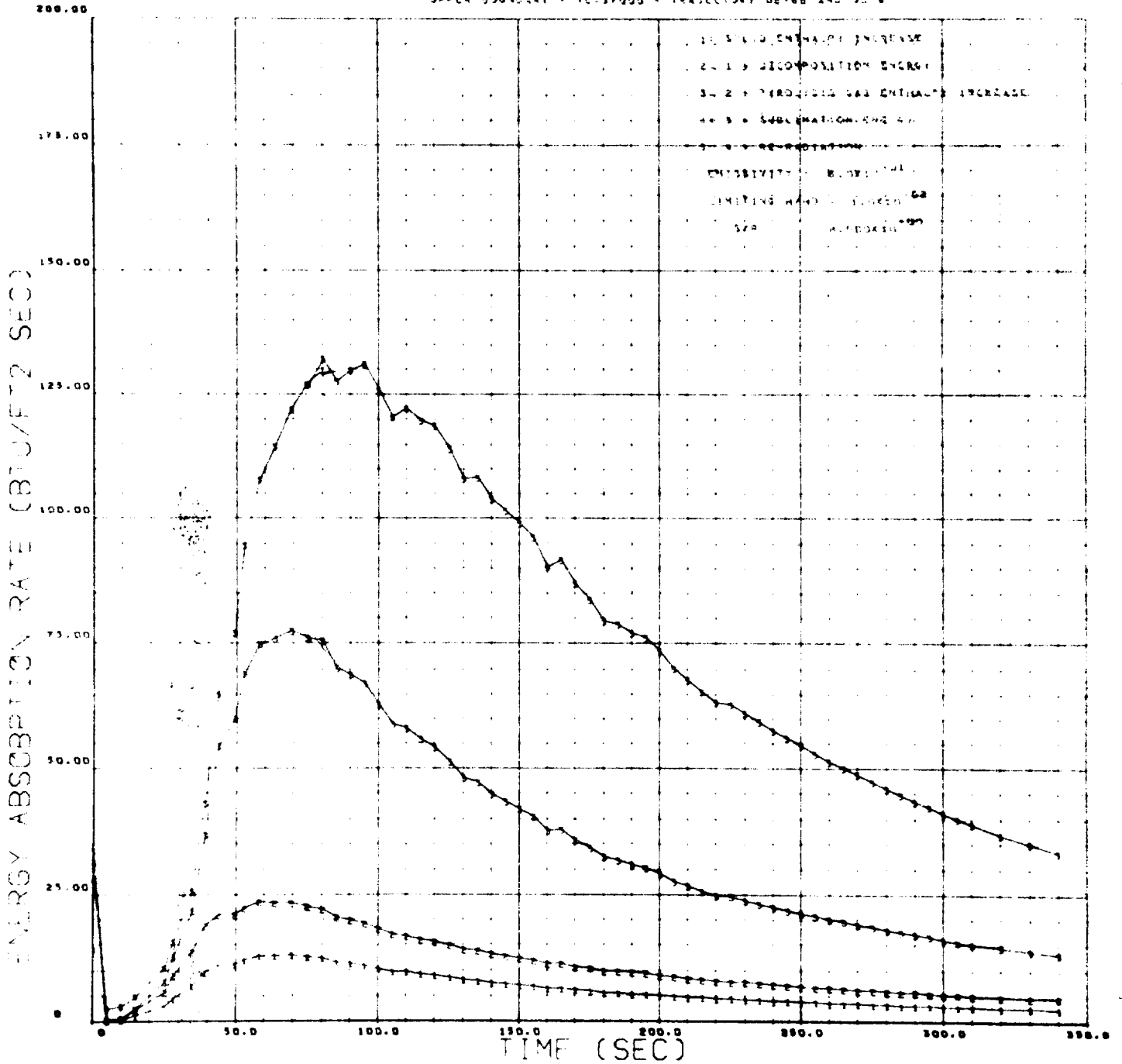


FIGURE B60

HEATING RATE HISTORY

UPPER BOUNDARY - VE 37000 TRAJECTORY UB-60 AND UB-67

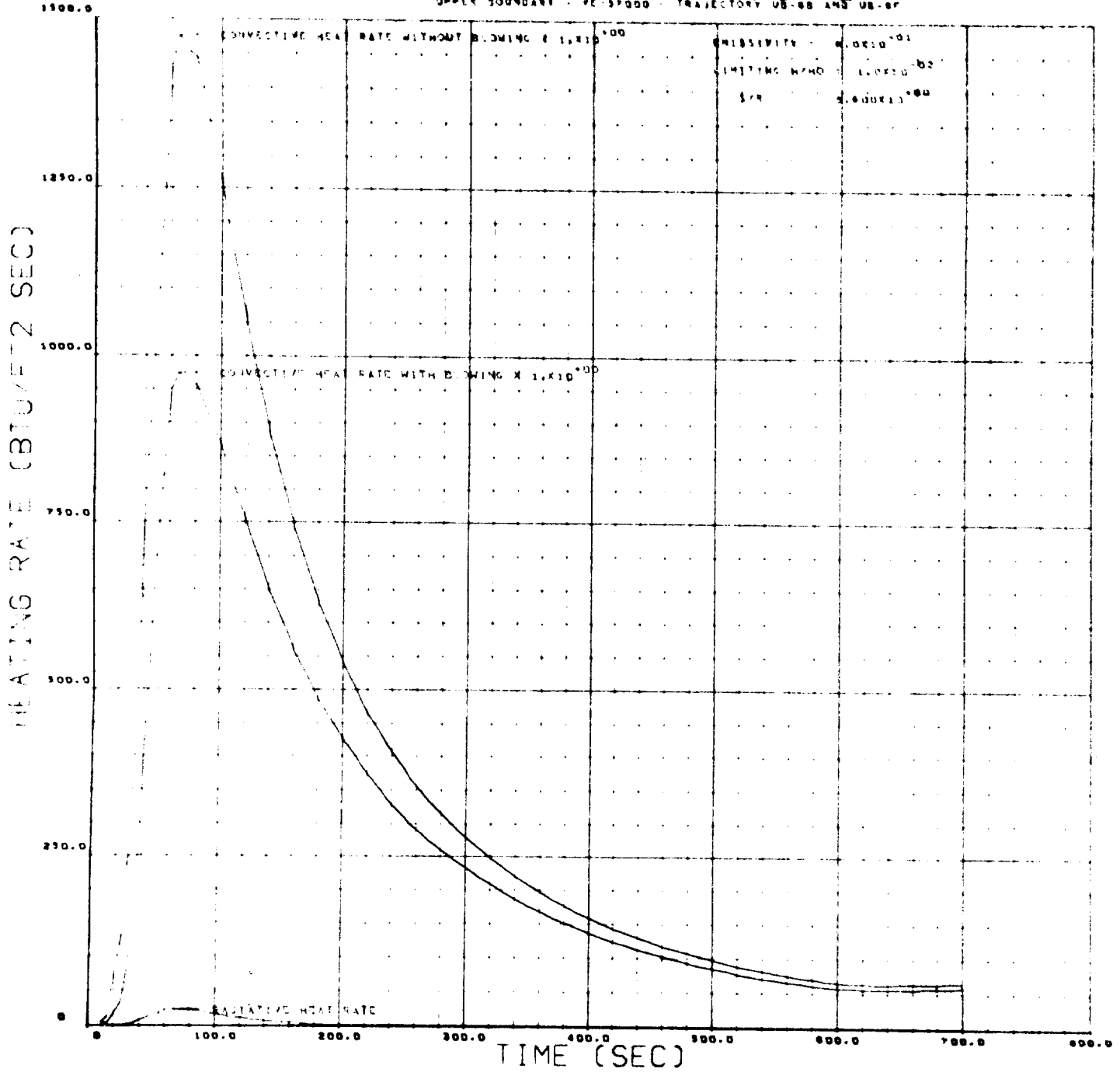


FIGURE B60

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VE: 57000 - TRAJECTORY UB-69 AND UB-67

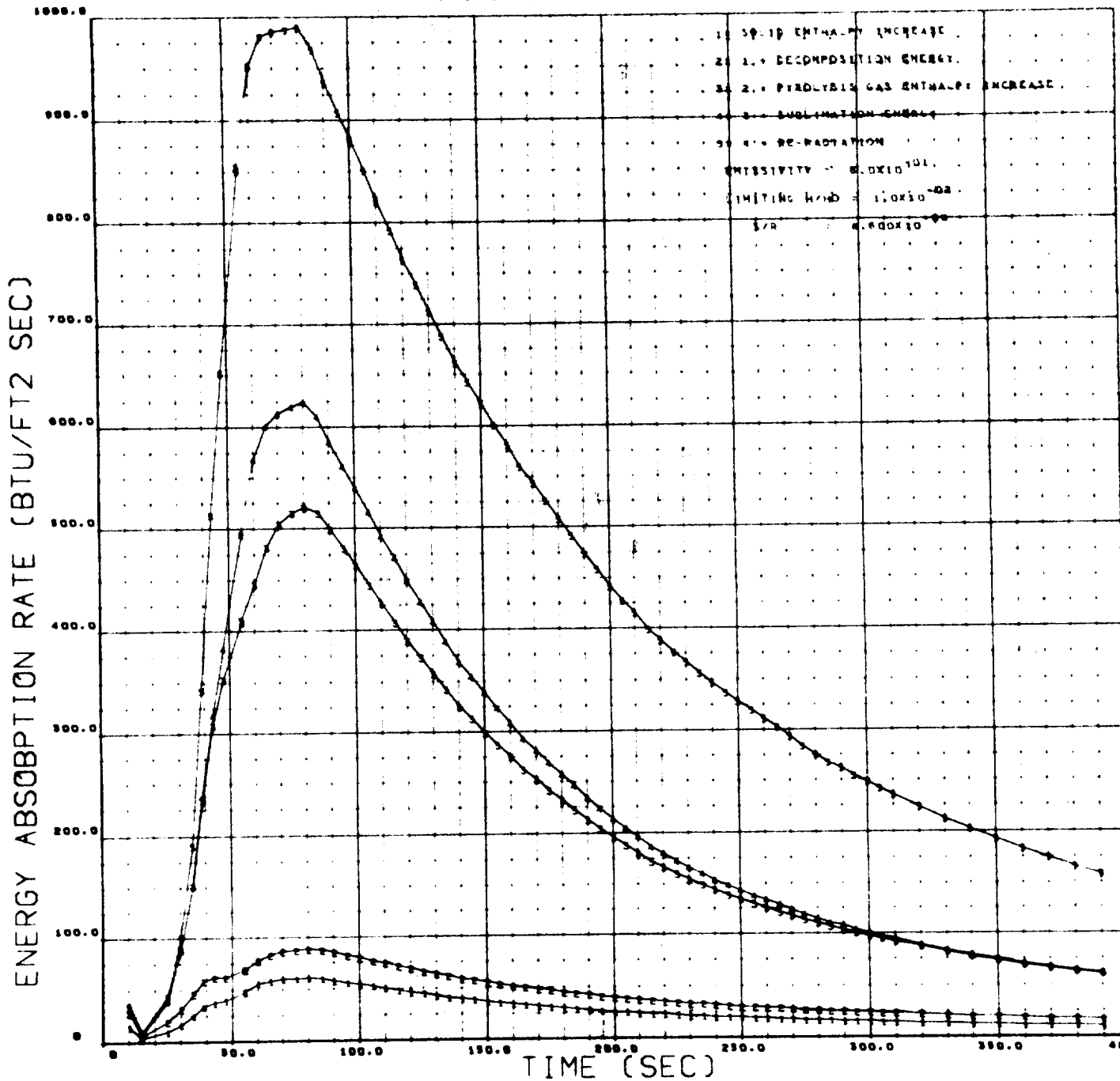


FIGURE 861

HEATING RATE HISTORY

UPPER BOUNDARY - VELOCITY - TRAJECTORY 08-68 AND 08-67

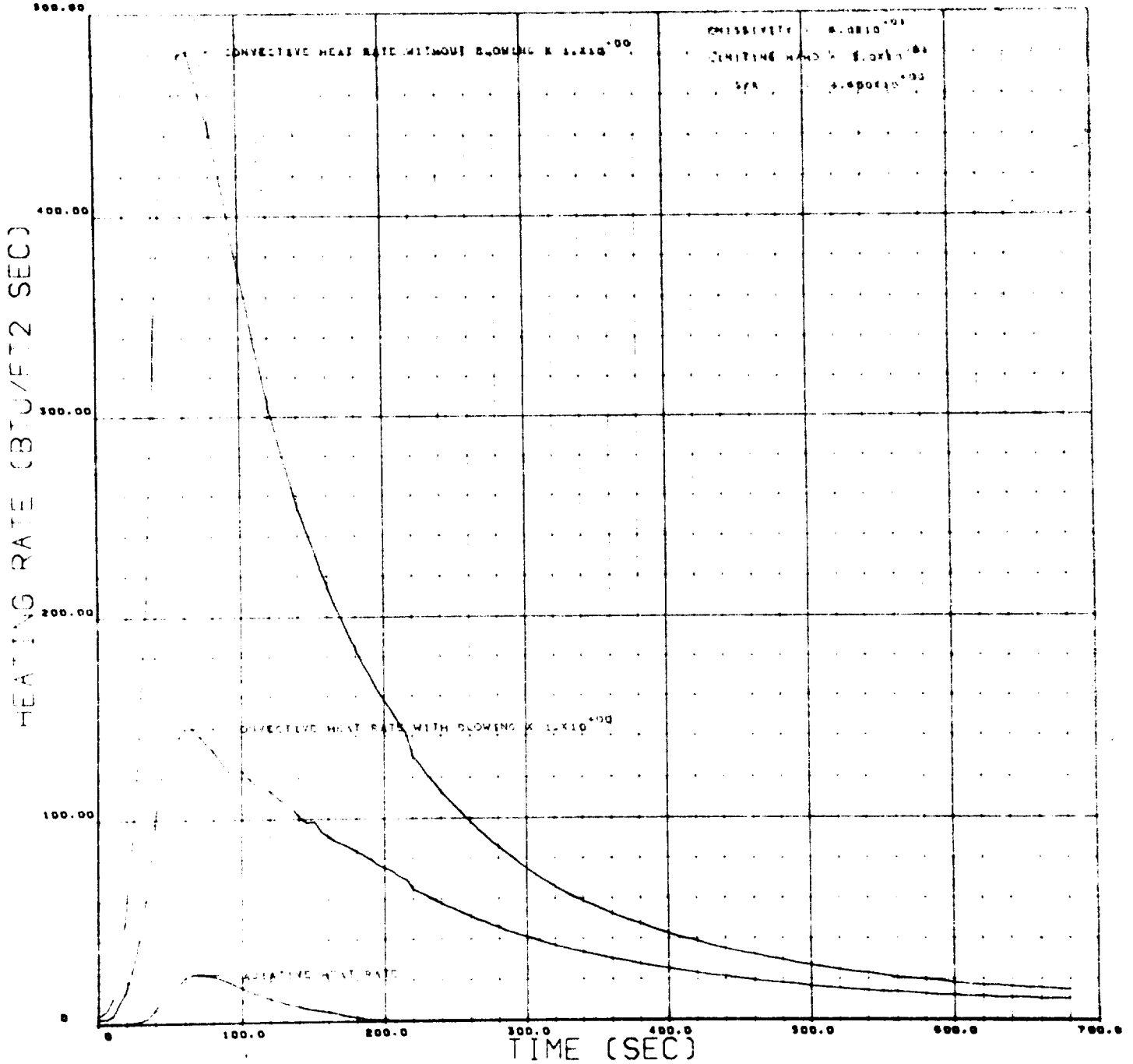


FIGURE 861

MATERIAL RESPONSE DATA

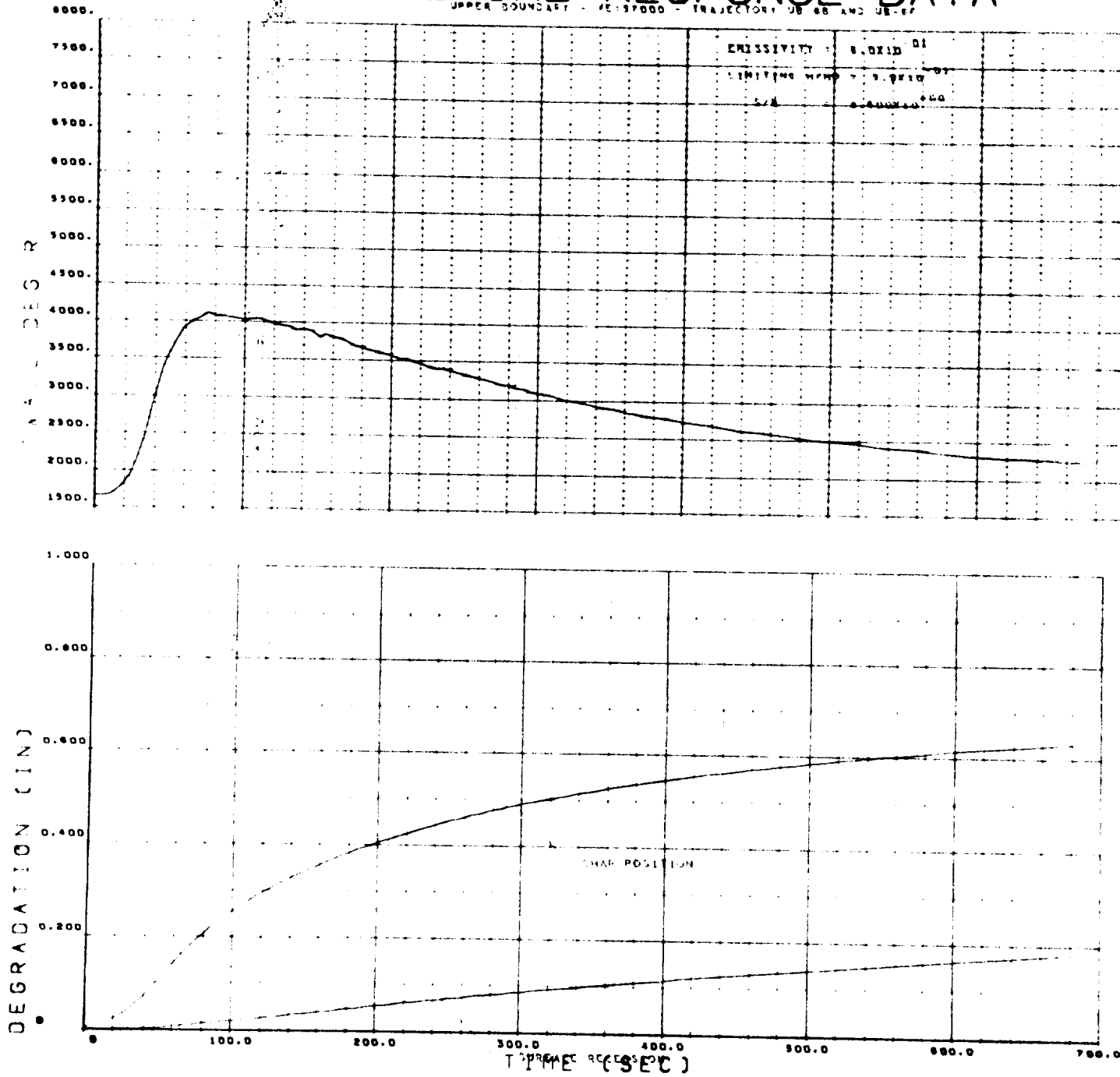


FIGURE 061

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VC-57000 - TRAJECTORY 08-88 AND 08-97

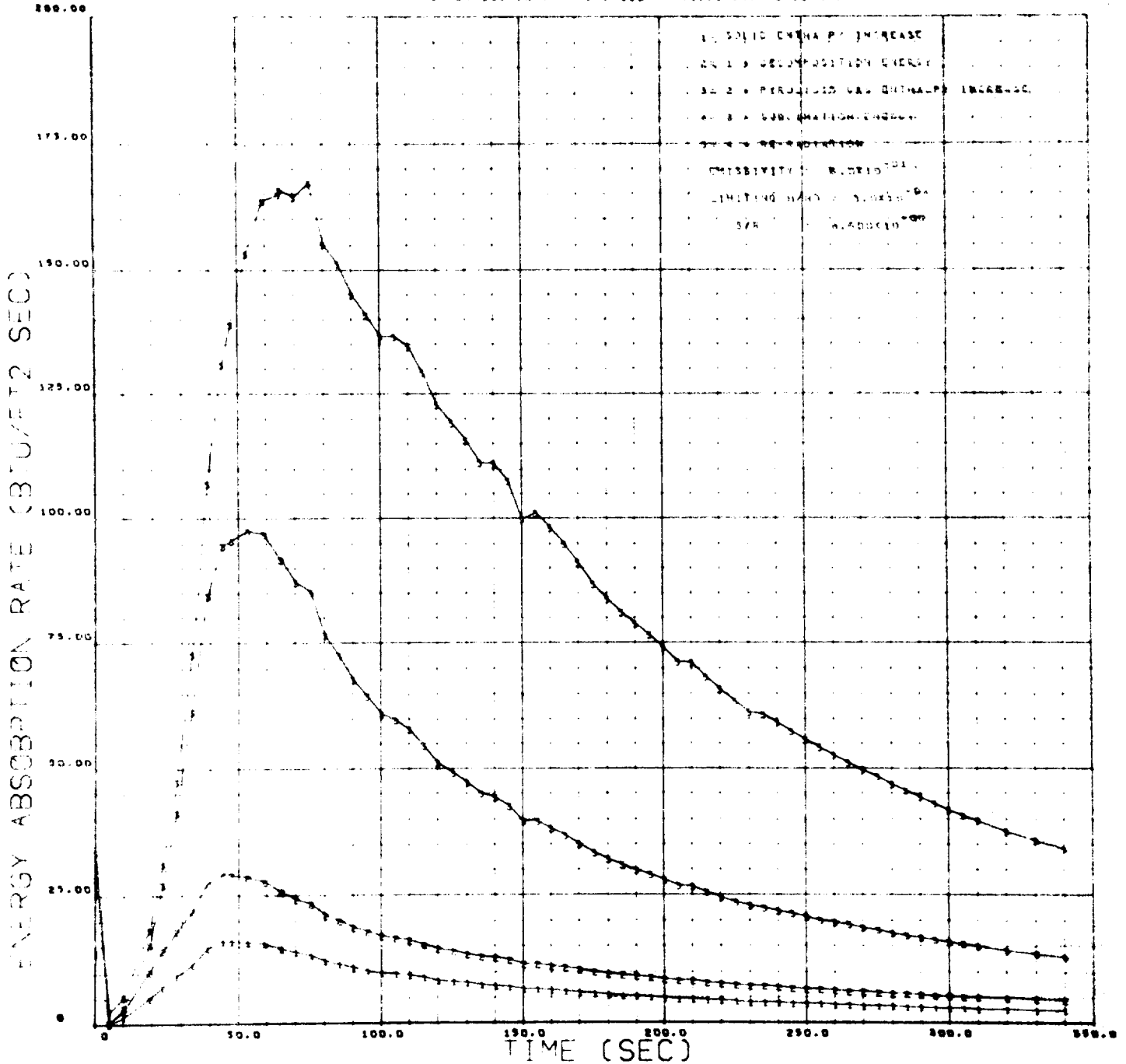


FIGURE B62

HEATING RATE HISTORY

UPPER BOUNDARY - VE=37000 - TRAJECTORY UB-88 AND UB-87

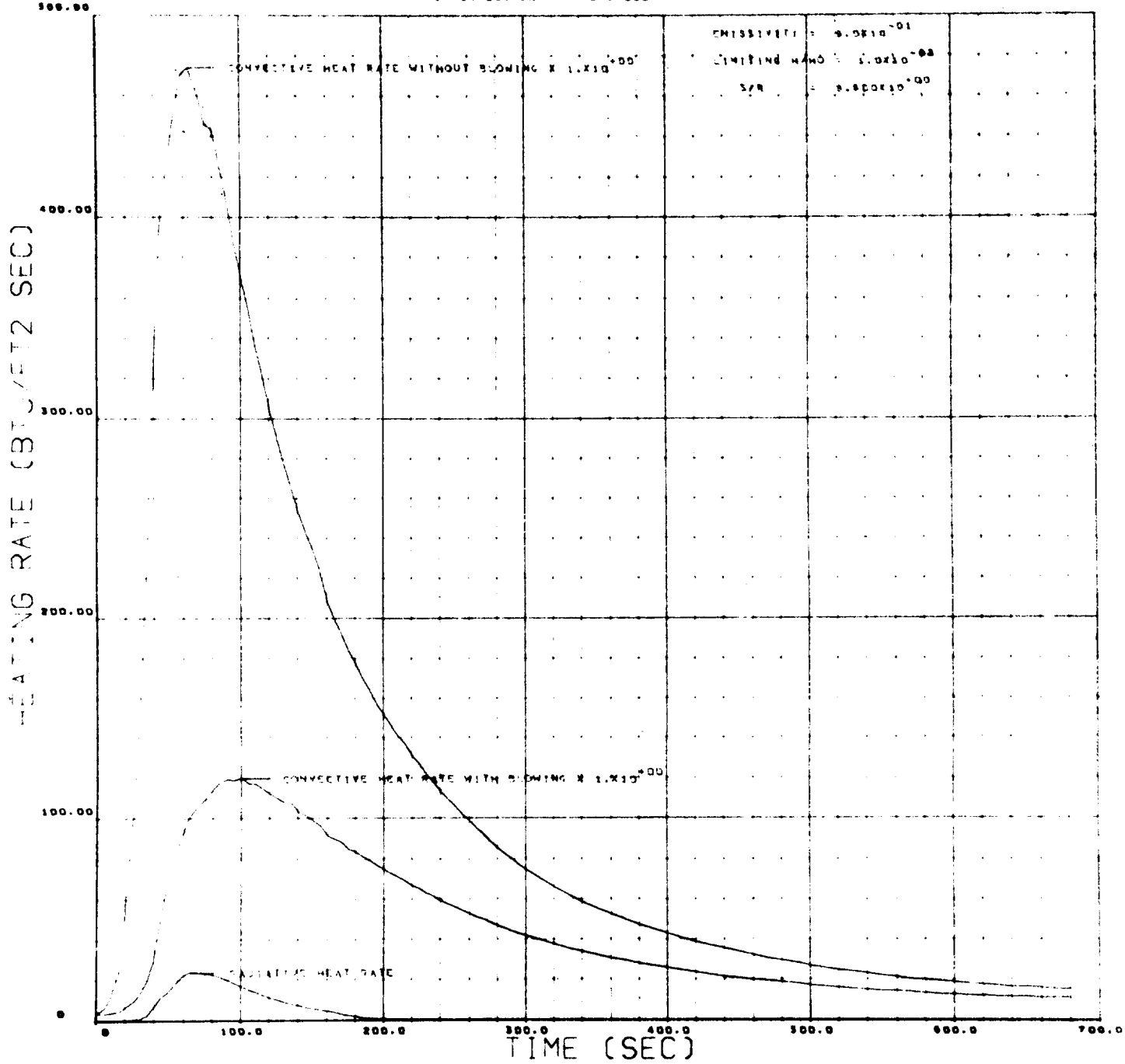


FIGURE B62

MATERIAL RESPONSE DATA

UPPER BOUNDARY - VE-37000 - TRAJECTORY UE-68 AND 75-67

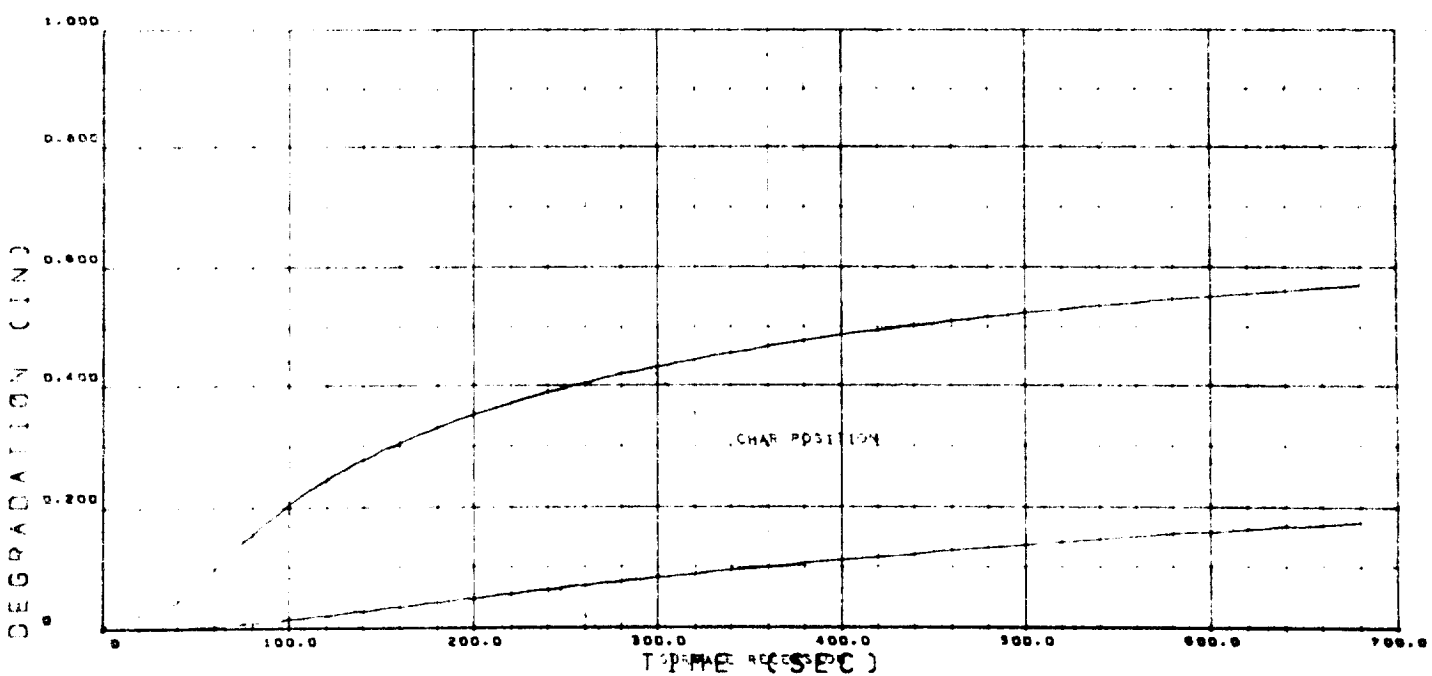
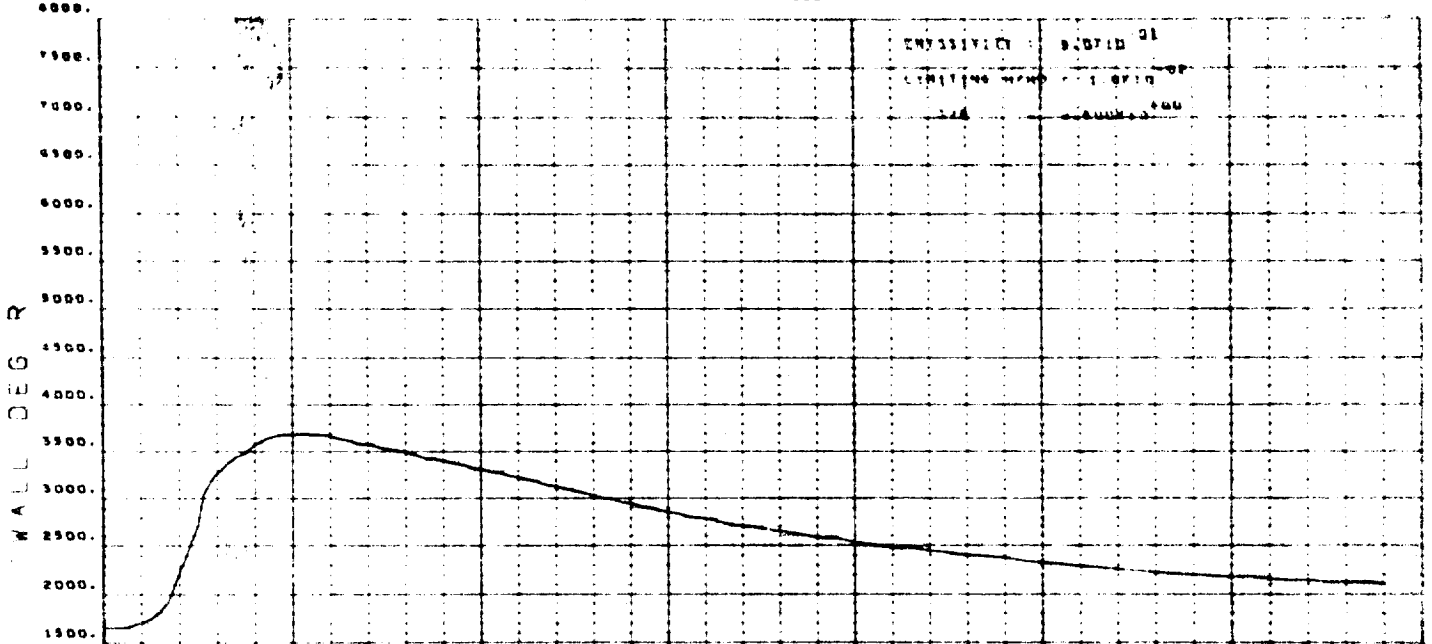


FIGURE 862

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VE=37000 - TRAJECTORY US-66 AND US-67

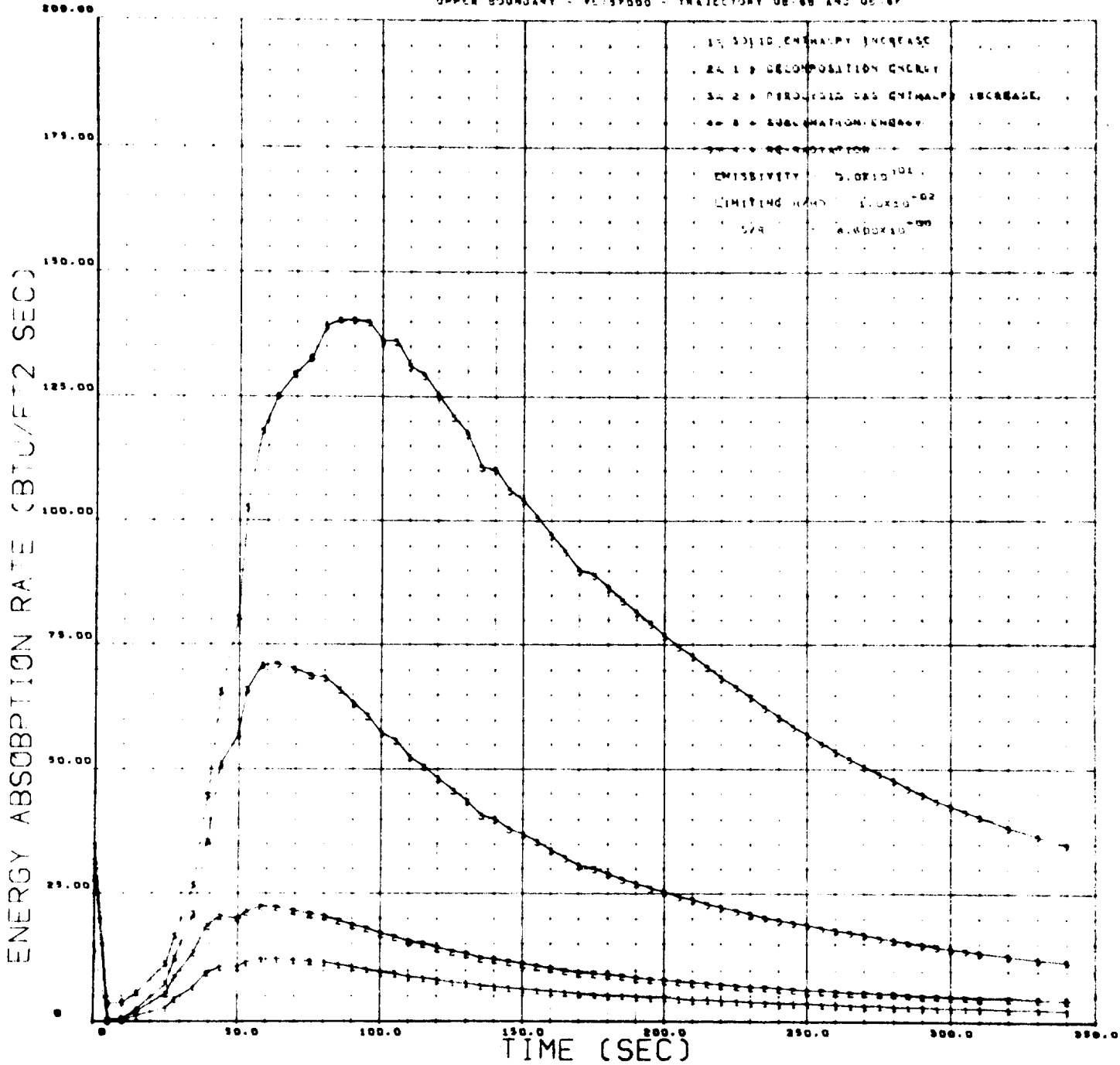


FIGURE 363

HEATING RATE HISTORY

UPPER BOUNDARY - VE=37000 - TRAJECTORY UJ-68 AND UJ-67

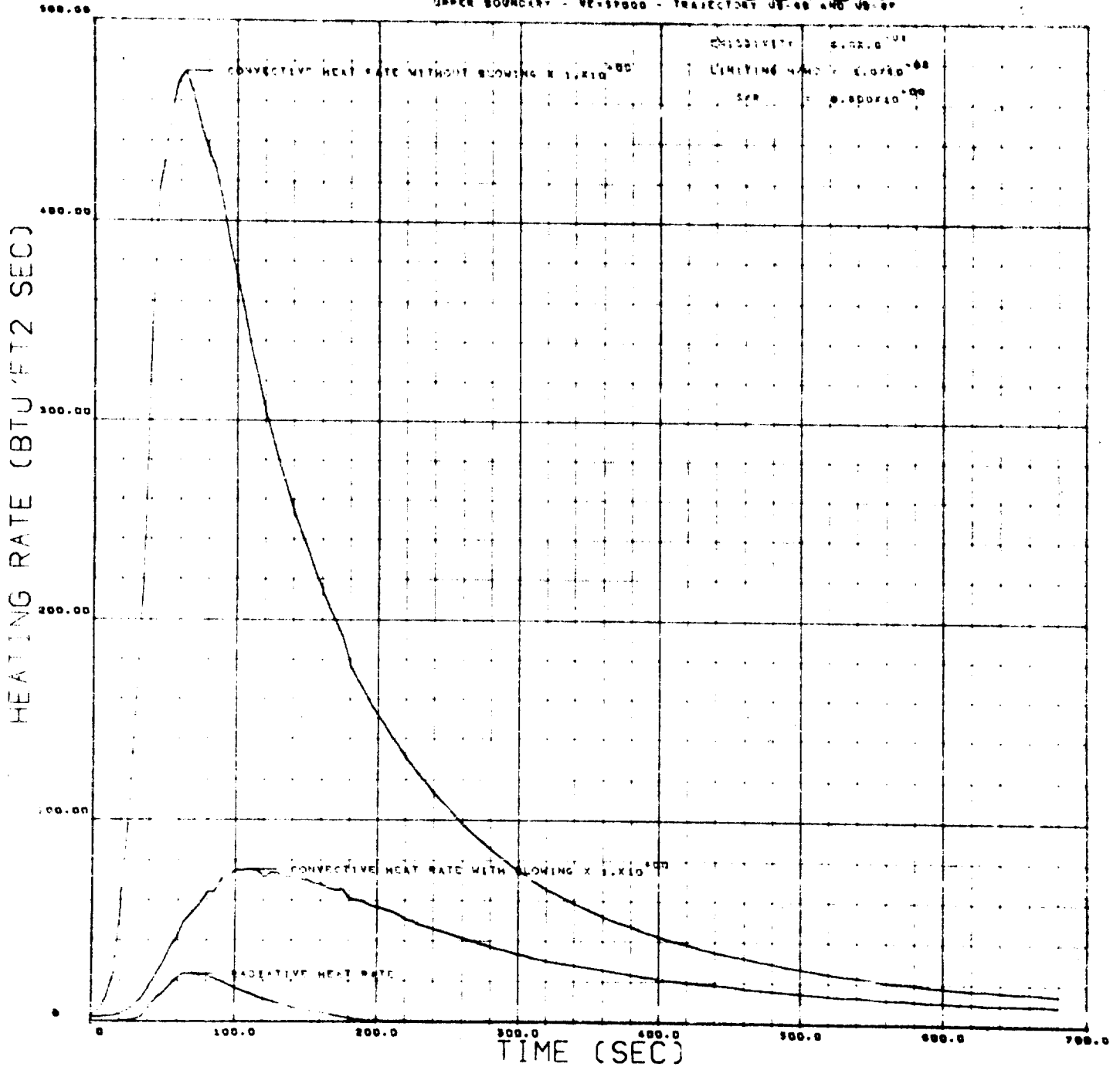


FIGURE 363

MATERIAL RESPONSE DATA

UPPER BOUNDARY - VE-37000 - TRAJECTORY VE-68 AND VE-67

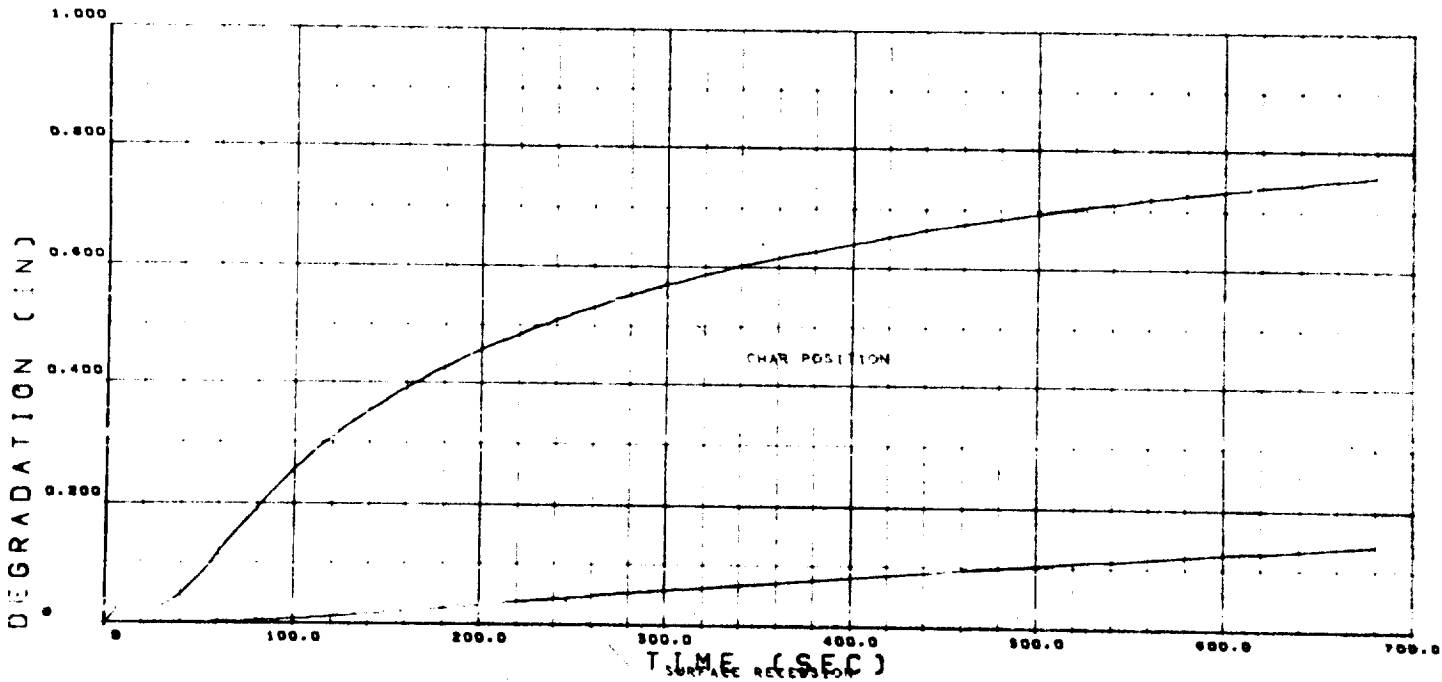
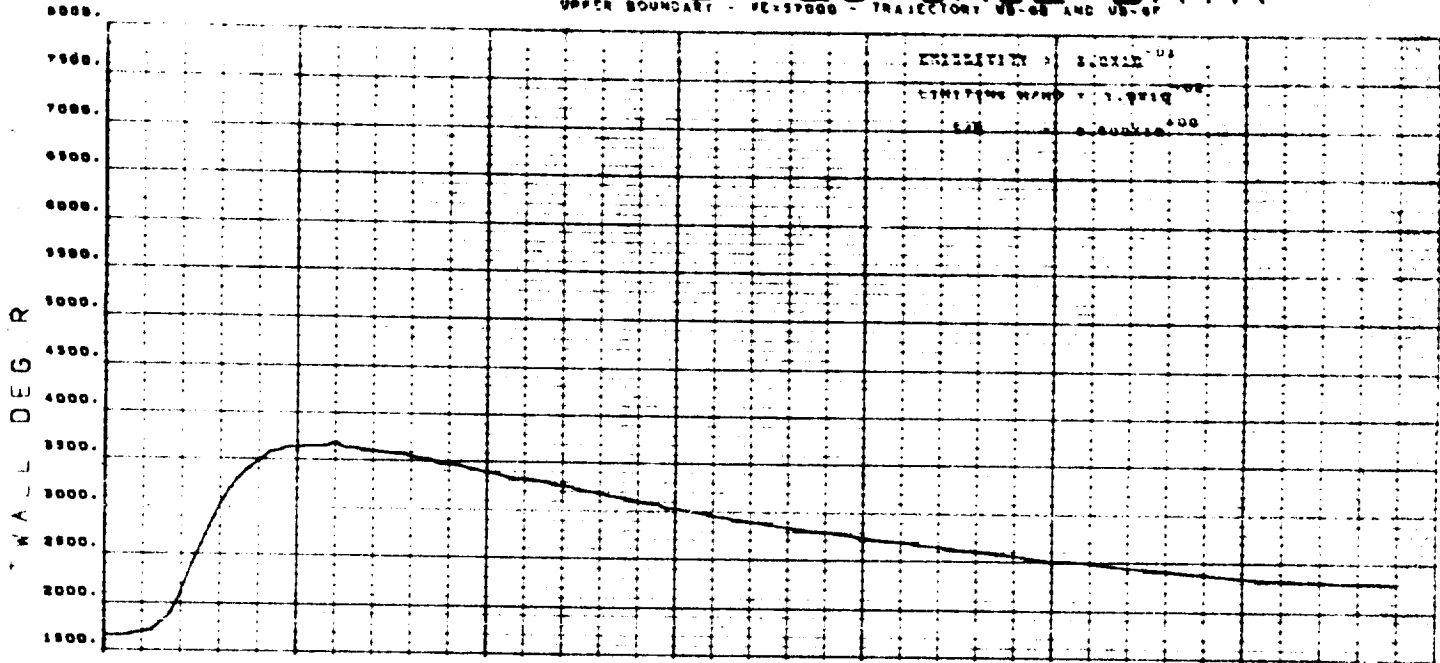


FIGURE 863

ENERGY ACCOMMODATION MECHANISMS

UPPER BOUNDARY - VC-57000 - TRAJECTORY UB-66 AND UB-67

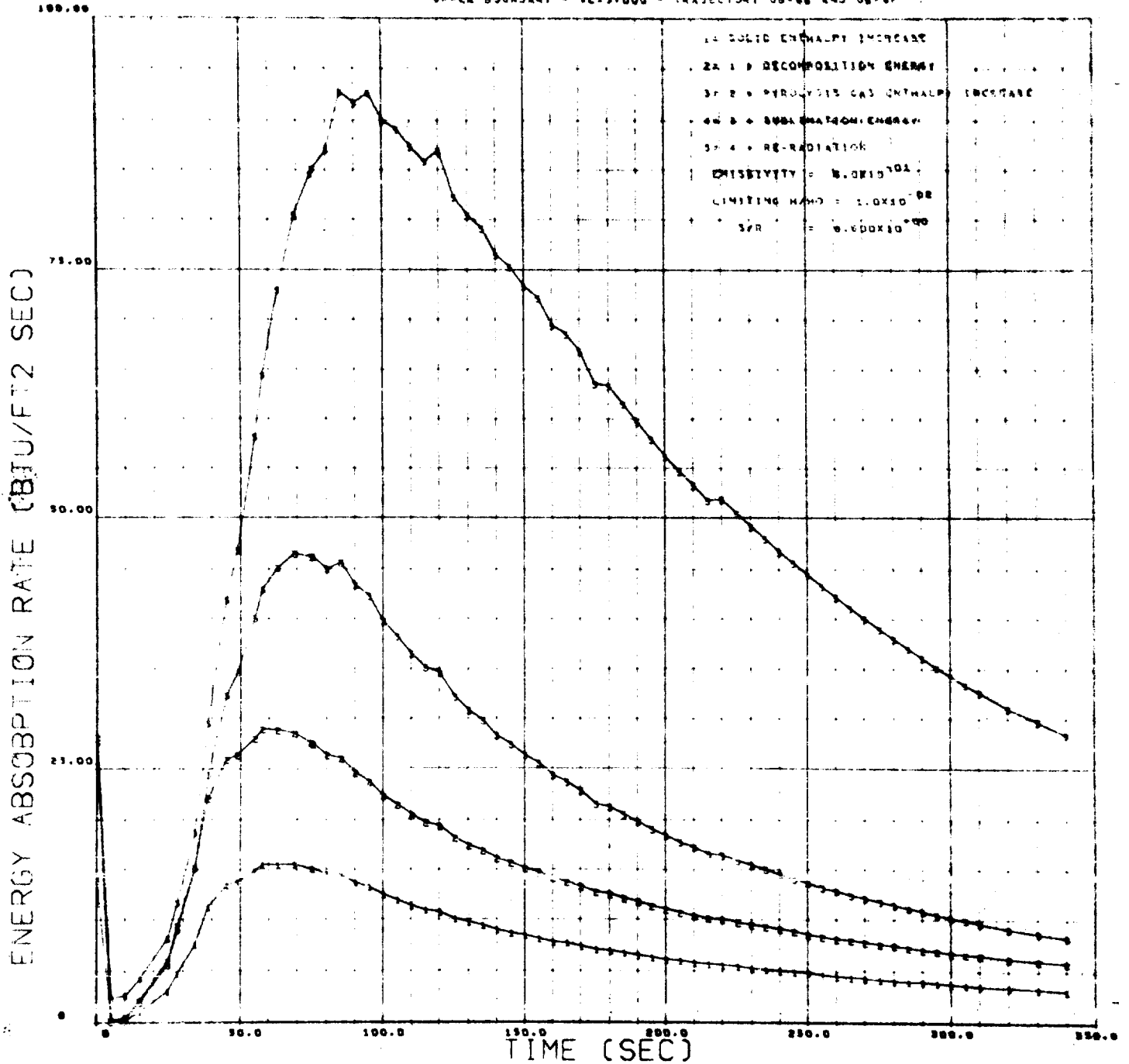


FIGURE B64

HEATING RATE HISTORY

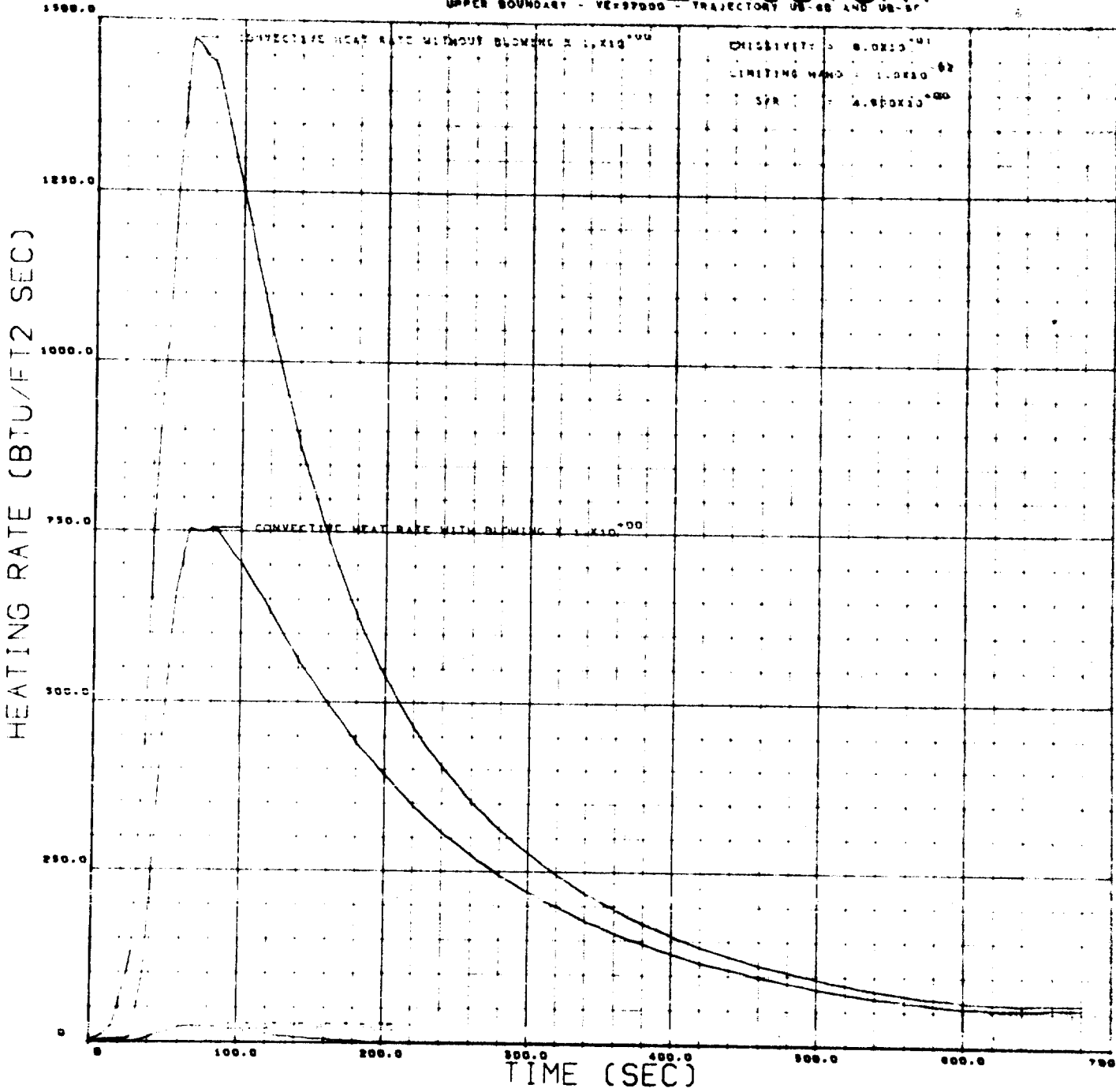


FIGURE 1364

MATERIAL RESPONSE DATA

UPPER BOUNDARY VE=37500 - TRAJECTORY UB-05 AND UB-07

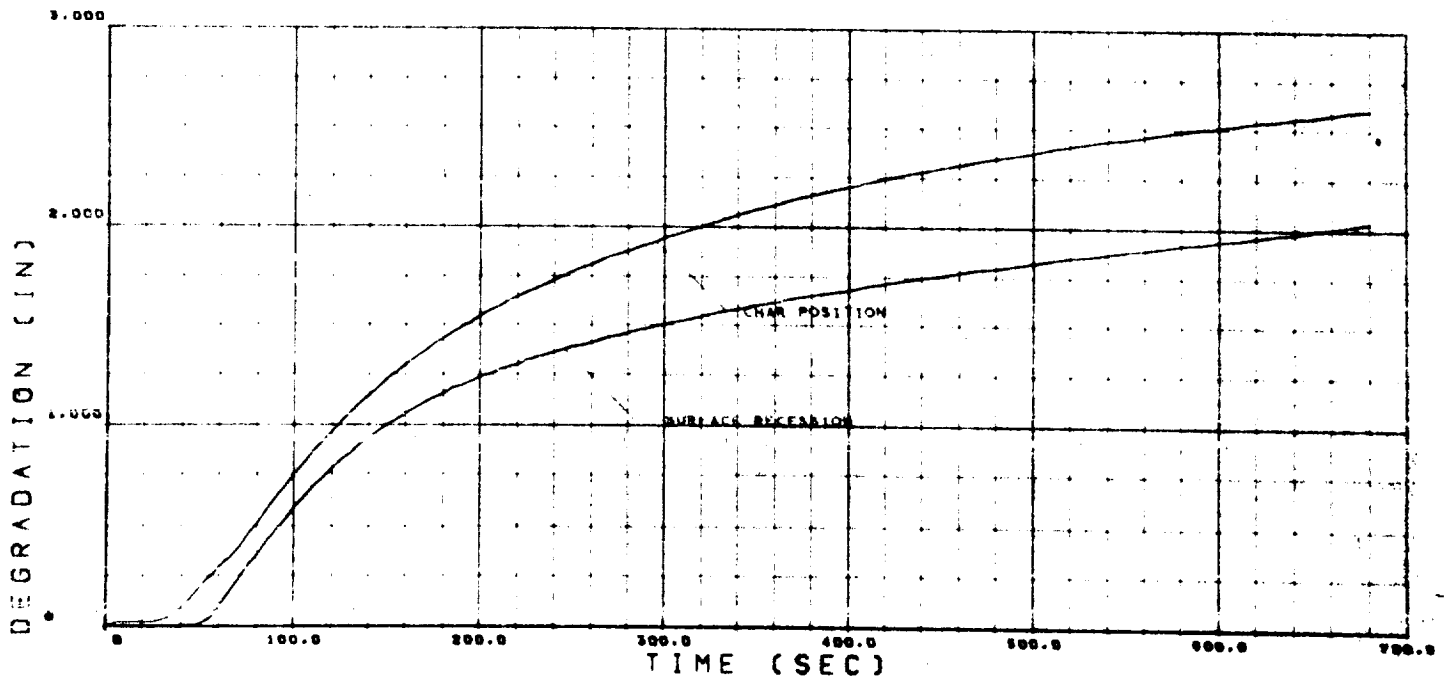
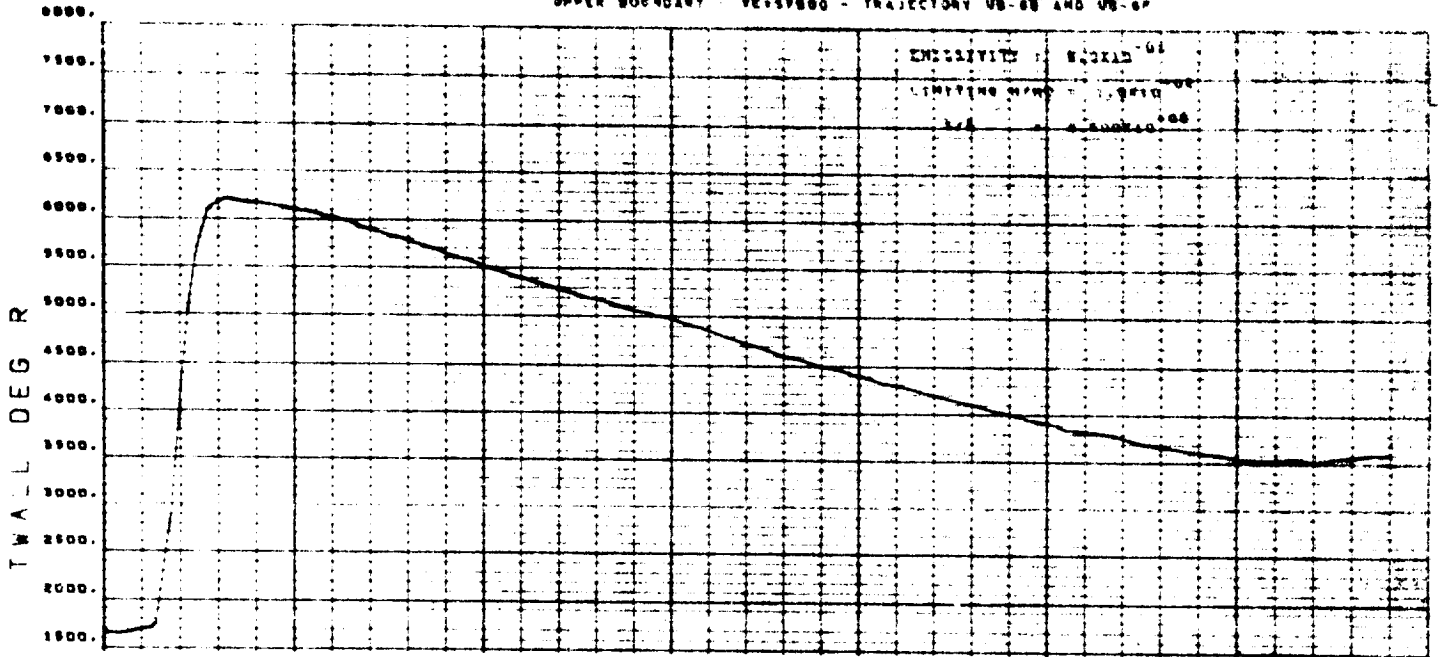


FIGURE B64

ENERGY ACCOMMODATION MECHANISMS

